SCIENTIFIC AMERICAN

A Weekly Review of Progress in

INDUSTRY · SCIENCE · INVENTION · MECHANICS

IN THIS ISSUE:

Developing One Million Horsepower from Tidal Energy

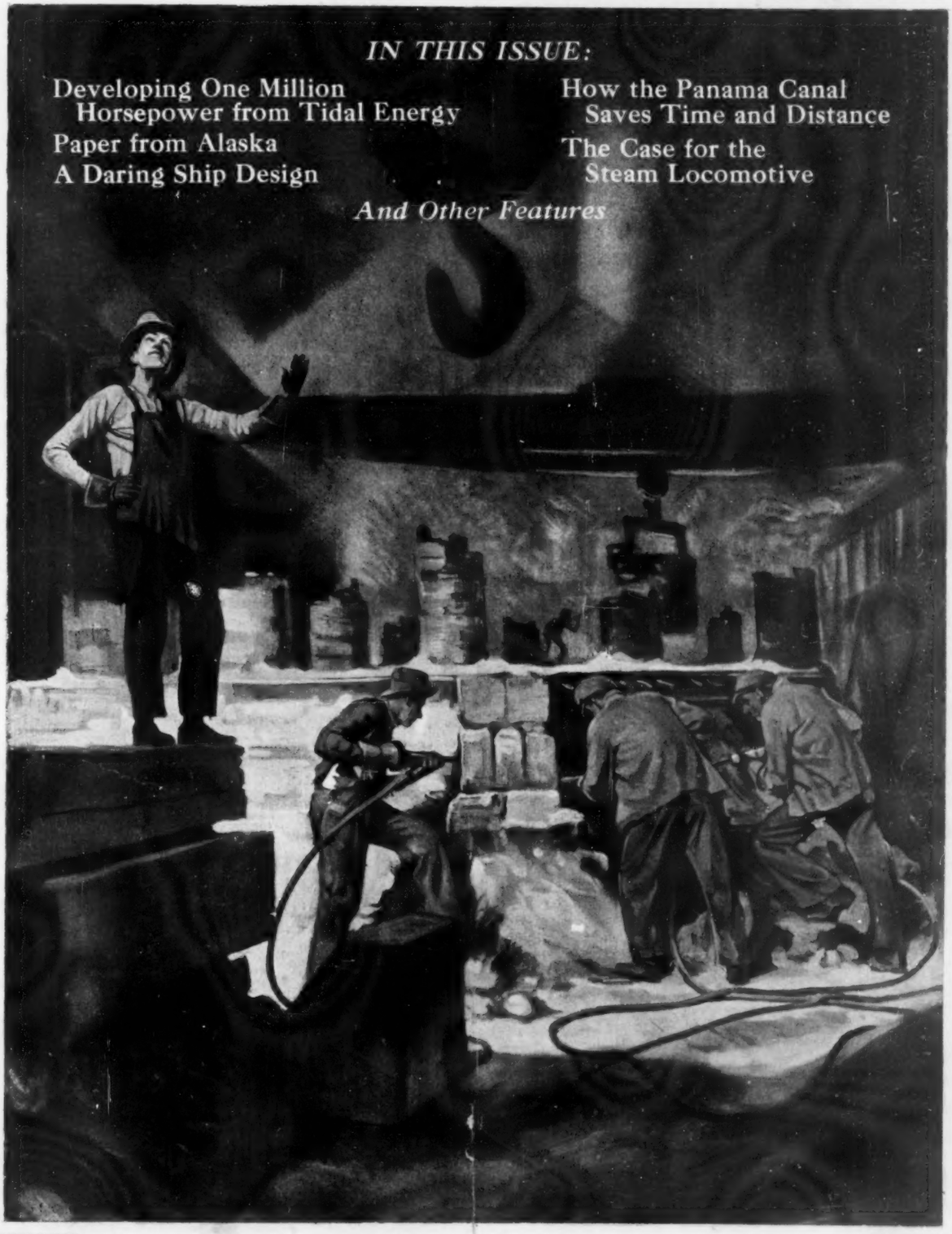
Paper from Alaska

A Daring Ship Design

How the Panama Canal Saves Time and Distance

The Case for the Steam Locomotive

And Other Features



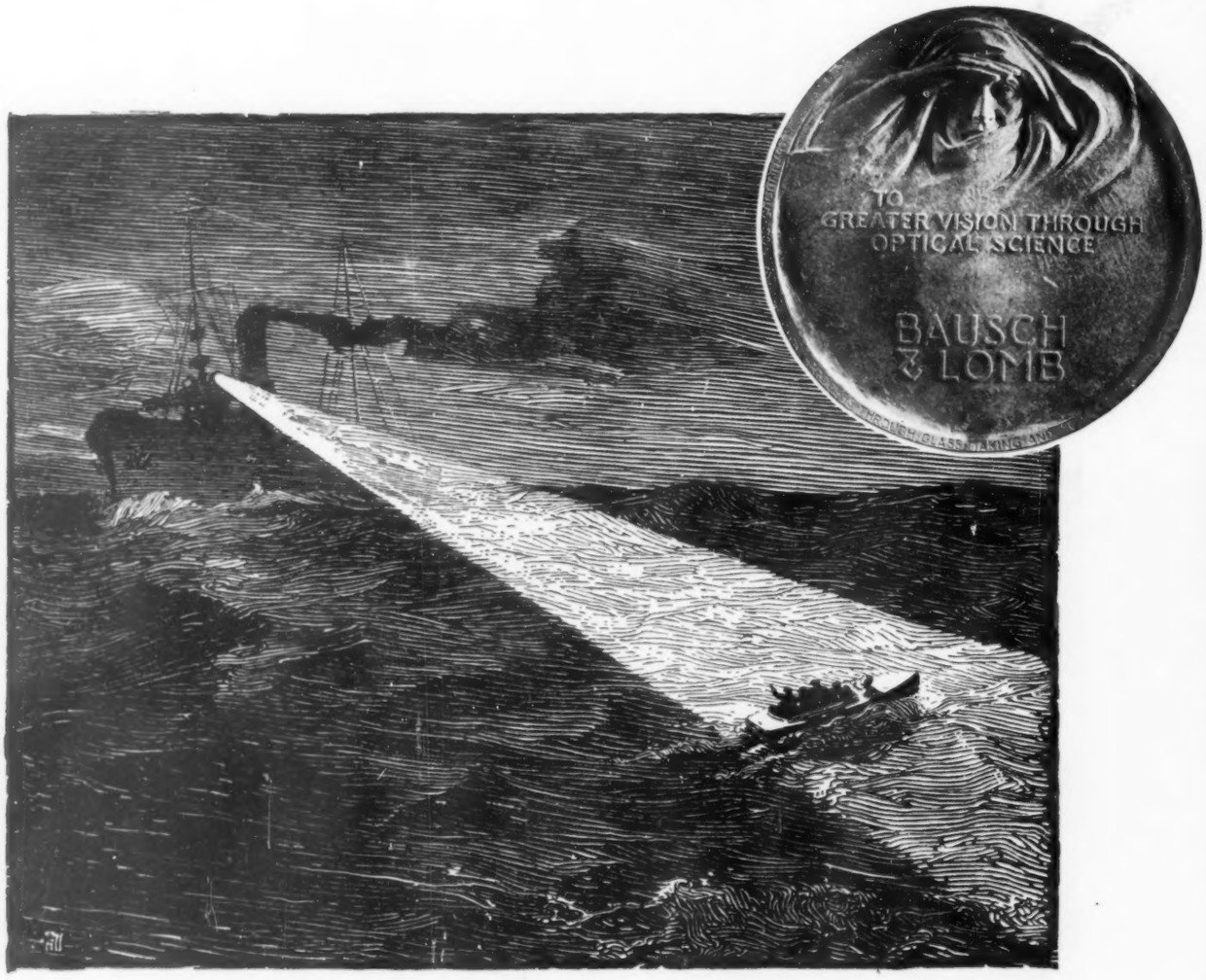
CLEANING A HUGE MOTOR FRAME CASTING AFTER IT HAS COOLED.—[See page 69]

Vol. CXXIV. No. 4
January 22, 1921

Published Weekly by
Scientific American Publishing Co.
Munn & Co., New York, N. Y.

Price 15 Cents
20 cents in Canada

Entered as second class matter June 18, 1879, at the post office at New York, N. Y., under the Act of March 3, 1879



Spotted—by the lens-mirror of the Sea!

INKY black—the great wastes of ocean, and o'erhead only the faint glow of the milky way with its starry accompaniment.

Smugglers, and those who prefer their activities concealed, find safety in this all-pervading blackness. Yet, to uphold the majesty of the law, these lanes of darkness must be policed.

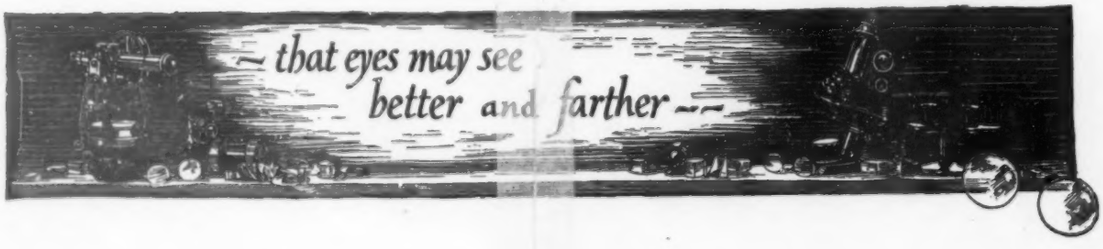
Suddenly a brilliant beam circles the horizon. Quick as a flash it casts a penetrating ribbon of light—anywhere!

Wonderfully wrought lens-mirrors gather and project the brilliant light from powerful lamps—light that would be wastefully scattered without the help of these lens-mirrors.

Though little known, this activity of this institution, is of equal importance and compares in service with our other products—lenses for photography and projection, microscopes, binoculars, lenses for army, navy and engineering use, and most important of all, to humanity—spectacle lenses—for all are made that eyes may see better and farther.

BAUSCH & LOMB OPTICAL COMPANY . . . ROCHESTER, N. Y.

Makers of Eyeglass and Spectacle Lenses, Photographic Lenses, Microscopes, Balopticons, Binoculars and Engineering and other Optical Instruments

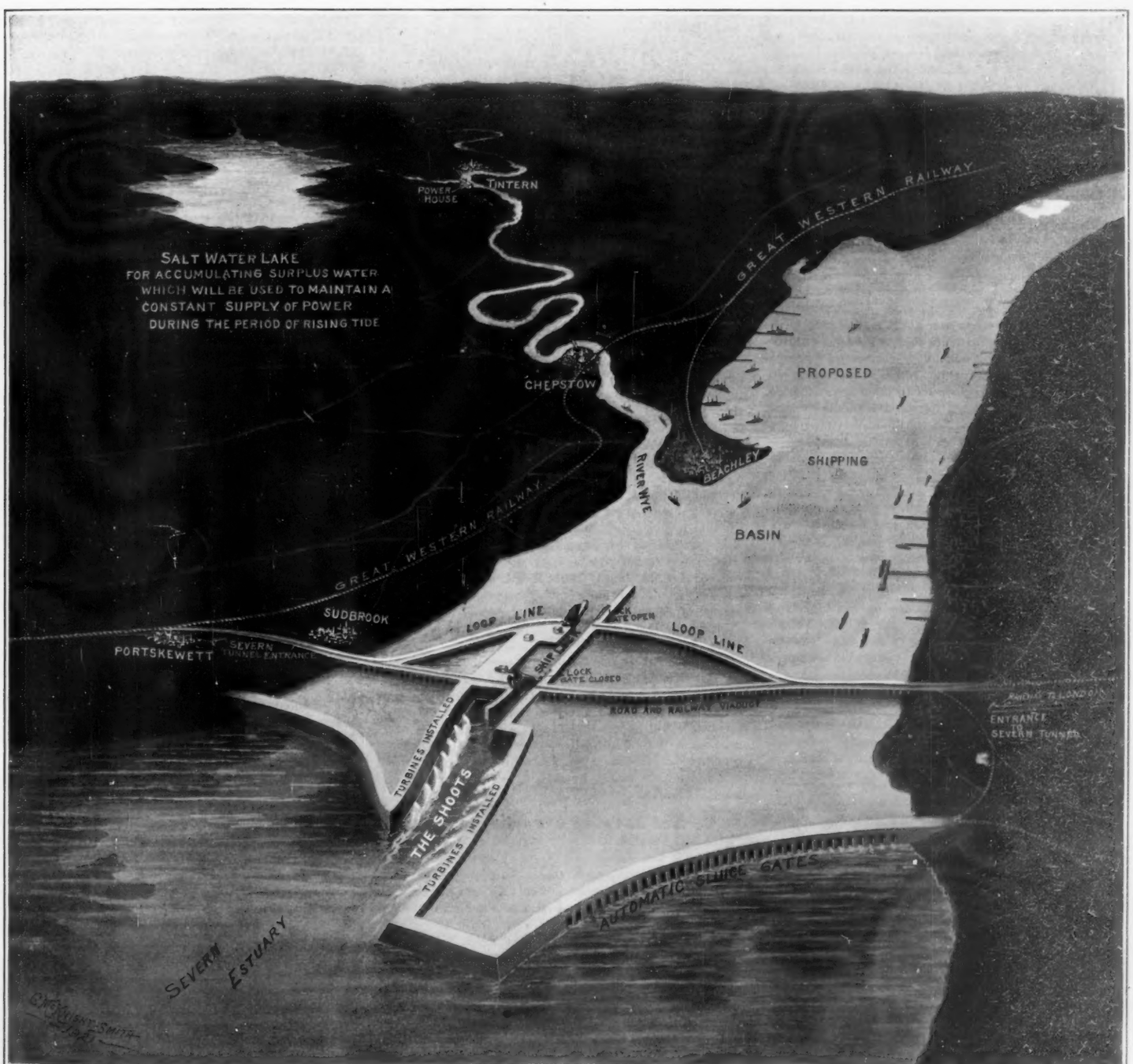


SEVENTY-SEVENTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXXIV. NUMBER 4 | NEW YORK, JANUARY 22, 1921 | 15 CENTS A COPY 20 CENTS IN CANADA



Scheme, drawn up by the Engineers of the British Ministry of Transport, for developing 500,000 horsepower from the 30-foot tide in the estuary of the River Severn—[See page 67]

THE SCIENTIFIC AMERICAN, January 22, 1921. Volume 124, Number 4. Published weekly by Scientific American Publishing Company at 233 Broadway, New York, N. Y. Subscription price, $6.00 per year. Entered as second-class matter June 18, 1879, at the post office at New York, N. Y., under the act of March 3, 1879.

SCIENTIFIC AMERICAN

Published by Scientific American Publishing Co.
Founded 1845
New York, Saturday, January 22, 1921
Munn & Co., 233 Broadway, New York

Charles Allen Munn, President; Orson D. Munn, Treasurer
Allan C. Hoffman, Secretary; all at 233 Broadway

Entered at the Post Office of New York, N. Y., as Second Class matter. Trade Mark Registered in the United States Patent Office.

The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

Labor and the Industrial Engineer

THOSE of us who were in close touch with the industrial situation twenty-five years ago will realize as they read Mr. Gompers' letter on the facing page that we have reached a notable milestone in the progress of industrial relationship.

Twenty-five years ago we knew little, if anything, of the industrial engineer in the present special meaning of that term. In those days the age-long prejudice of labor against labor-saving machinery was still encumbering the wheels of progress, although the more intelligent workmen were beginning to understand that the labor-saving machine, so far from being an enemy, was a friend. In the intervening period, however, the hard logic of facts has driven home to the great mass of labor the fundamental truth that, although the introduction of labor-saving machinery may cause a temporary reduction in the working force, it ultimately enlarges the demand for labor by increasing production, reducing the cost, and multiplying the public demand for the finished product. No workman, however humble his position or however simple his processes of thought, can fail to contemplate such a modern industry, let us say, as the Ford plant, with its 50,000 workmen, its output of 3,000 machines per day, and its minimum daily pay of six dollars, without realizing that the automatic machine and the traveling worktable are his very best friends.

While this lesson was being taught, there appeared in industry a specialized type of engineer who directed his attention not so much to the machine as to the man himself, with a view to simplifying and expediting his work by cutting out unnecessary movements and enabling him to do more work with the same total expenditure of effort. But the industrial engineer, when he applied his attention and skill in this particular direction, was met with something of the same prejudice on the part of labor as was shown, years before, at the first introduction of automatic machinery. But with the passage of time there came a better understanding on the part of labor and a modification of his plans on the part of the industrial engineer, with the result that the value of his work is so fully recognized that Mr. Gompers can say: "A change in the conclusions of a great many industrial engineers, scientists of industry, is making it possible now for labor to welcome coöperation with them, and for labor to do its full share in developing that coöperation."

Finally, there is the question of the coöperation of the employer, without whose understanding and sympathy no progress is possible. Fortunately, the great majority of the employers are alive to the vital importance of the question of industrial relationship. This is particularly true in that great industrial center known as the Middle West, where various schemes, differing in details of application but similar in recognition of certain fundamental principles, are in successful operation. Several of these have been published in our columns in a series entitled "Solving the Labor Problem." An outstanding feature in each of these systems has been the thorough coöperation of the employer, who in every case has been sympathetic and in most cases has been the leading spirit in the movement.

Science and the "scientific mind," as Mr. Gompers calls it, are no longer regarded as the friend of the employer and the foe of labor. That misconception has been buried under an accumulation of facts and experiences which have proved that it is equally the friend of both. Increasing production and decreasing costs are bringing an ever-larger demand for intelligent and well-paid labor.

Crippling American Aviation

WE recently took occasion to congratulate the Post Office Department on the extension of its Air Mail Service, and we were glad to note that the Postmaster General had asked Congress for an appropriation sufficient to insure the unhampered operation of the new aerial postal routes during the coming year. Unfortunately for the future of this service, Congress has refused to provide the full sum required, and in fact has made a drastic cut. Well may Otto Praeger, Second Assistant Postmaster General, predict that this ill-placed economy will be "a death blow to peace-time development of aviation!"

Just now the Air Mail Service is the mainstay of aviation in the United States. It is the only service which has Government backing, and it is the only service which is of sufficient size to call for a steady supply of airplanes to carry on. Unless Congress provides the necessary funds, some of the air routes must be abandoned, with a corresponding loss of orders to the few remaining firms which are struggling to keep their plants in operation.

We may just as well look the facts in the face, and acknowledge that the airplane industry is in a pretty bad way. Several of the leading industries are in the hands of the receivers and if the Government pursues its policy of retrenchment, Heaven alone knows where the few remaining firms are to look for support.

We are well aware that the present is a time for all-round retrenchment; but these economies should be carried out with discretion. Retrenchment should be made, first, in naval and military departments and not in those which have to do with peacetime civil utilities. If Congress is wise, it will give to the Aerial Mail Service the very modest sum that it asks, and balance the account by an equivalent cut where it will not be so deeply felt.

If the Air Mail Service were still in the purely experimental stage; if its aircraft were unable either to deliver the amount of mail predicted or make the saving of time which should be its chief recommendation; or if it had proved too much subject to the vagaries of wind and weather to render it an efficient system for the carriage of mail, the refusal of the funds requested would be more understandable. But, as a matter of fact, the mails have been carried regularly, expeditiously, and in great numbers, and these advantages have been gained at a cost which compares favorably, and in many cases more than favorably, with that of the regular train service. Judged by its record, this new venture should receive most generous consideration; for not only has the Post Office Department operated its mail lines over a distance that averages more than 6,000 miles every day, but it has extended its service from the Atlantic to the Pacific, and, during the past twelve months, it has carried over one hundred million letters.

The So-Called Armament Race

IT is a strange anomaly that though there is just now a world-wide discussion of the so-called race in armaments, such a competition does not in fact exist. On the other hand, if the present talk by the Secretary of the Navy and his immediate advisors about the necessity for us to build the biggest navy in the world is carried on much longer, the armament race will begin in good earnest. It cannot too frequently be impressed upon the American people that, as the naval situation stands today, there is no other country which has a large program of construction in hand. Japan, it is true, drew up a program for new battleships and battle-cruisers, prompted, so her statesmen tell us, by the declaration of our Naval Secretary that, if the nations of the world would not join the League of Nations in the form in which the present administration had drawn it up, he would be in favor not only of completing our present large program but of doubling it—a policy which would call for the expenditure of another billion dollars of the taxpayers' money to see it through. The new Japanese proposal is purely on paper and apparently, so far as anyone can ascertain, no appropriations have been made to carry it on. There is certainly no race in naval armaments that can be called such so far as active Japanese building operations are concerned.

With regard to Great Britain, it is sufficient to say that in the face of Mr. Daniels' threat, she deliberately scrapped all of her pre-dreadnaught battleships, broke up three sister ships to the "Hood," vessels of 42,000 tons which were already in course of construction, and made a sweeping clean-up of armored cruisers, protected cruisers, destroyers and submarines that were not of thoroughly modern construction. Furthermore, she reduced her personnel from some 450,000 men to about 100,000, which is over 30,000 less than the present enlisted strength of our own Navy. And for two years past, in spite of the, shall we say, militaristic attitude of our formerly pacifistic Secretary, she has drawn up no program whatsoever for future new construction. Evidently, there is no race in naval armaments between the United States and Great Britain.

Nevertheless, in spite of the mortification with which the great body of the American people have witnessed this ill-timed and uncalled-for "swash-buckling," it has not been without its good effects. It has served to call forth, mainly through the efforts of one of our great leading dailies, a widespread protest against the continuation of huge appropriations for naval and military construction, which has been surprising in its world-wide range and unanimity of sentiment. Both here and abroad, statesmen of all shades of political opinion, naval and military officers of the highest rank, leaders of thought in the church, at the bar, in education, and in literature, have responded in no unmeasured terms of approval to the suggestion, that the nations of the world should get together in an endeavor to reduce their existing naval and military programs and cut down future appropriations to the requirements of post-war conditions.

Among the very few dissenting opinions are those of a few men who fear that the present agitation may throw this country back into the condition of unpreparedness with which it was confronted at the beginning of the late war. The SCIENTIFIC AMERICAN does not believe that there is ground for any such anxiety. Not during this generation at least will the American people forget the lesson of that feverish period, when we endeavored to do in one year what could have been so much more cheaply and better done in the previous ten years. When they are engaged in the pastime of filling in their annual tax papers and enclosing the accompanying check, they will have a periodical and very poignant reminder of the costliness of unpreparedness. Nobody, of course, who is qualified to speak on the subject of disarmament would wish to see the wholesale scrapping of our fleets, razing of our forts, and destruction of our accumulated artillery. What is needed and what we believe will come is a great reduction of present shipbuilding and a mutually agreed upon adjustment of the relative strength of armies and navies to the several needs of the nations concerned.

So far as the great peoples which fought together for the principles of justice and humanity are concerned, this adjustment should present no insuperable difficulties. Such unrest and mutual distrust as seems to have developed among the Allies since the armistice has been altogether artificial in its origin. It is the result of an insidious propaganda, largely racial in its origin, which has been deliberately designed to break up that unity of feeling between us and our Allies, and particularly between the United States and Great Britain, which was, and ever will remain, the greatest asset of the late war.

The slogan of this propaganda is the phrase, "Freedom of the Seas," which had its origin centuries ago, and was resurrected by Germany when she began to feel the pinch of the blockade. It was aimed, of course, against the British fleet, which, thank Heaven, was strong enough to preserve the freedom of the seas, for herself and her Allies to move their armies when and where they would. For all law-abiding and peaceful merchant ships the seas have been "free" for a hundred years past.

Electricity

Electric Incubator.—An ingenious inventor of Racine, Wis., has recently introduced an electric incubator especially designed for city and suburban poultry raisers. It has a capacity of seventy-five eggs and is heated by means of two electric light globes placed in the top compartment. Between these globes and the lower egg chamber is a steel plate which retains and distributes the heat. A thermostat regulates the heat and keeps it at 103 deg. all the time.

Better Telephony.—From France comes a new idea in the way of better telephony, consisting in amplifying the telephone currents immediately upon their leaving the microphone transmitter to such an amplitude that the power-line disturbances become relatively insignificant. A vacuum-tube amplifier is used in each end of the line. The signals are reduced to normal strength at the receiving end by connecting high resistance in series with the receiver or by using a non-inductive shunt. It is claimed that satisfactory protection may be obtained by this French system, even when the telephone line runs along a single-phase railroad without balancing return feeder, or when it is carried on the same poles as a high-tension transmission line.

The Golpa Super-Power Station.—The steam generating plant at Golpa, Germany, from the beginning was intended to provide the nitrogen-fixation plants at Piesteritz with 500,000,000 kw-hr. of electrical energy a year and also to supply a large nitric-acid plant in the neighborhood with about half of this amount, according to *Electrical World*. The generating plant is located close to a lignite mine, the cable cars take the coal directly from the mine to the stokers. The daily consumption is 6,000 tons. There are sixty-four steam boilers, feeding eight turbines, each coupled to one 22,000 kva. generator of 6,000 volts and 50 cycles. After the shutdown of the wartime nitric acid plant the output from part of the units was taken over by the city of Berlin, the power being transmitted over a 78-mile, 110,000-volt line.

Alternating-Current Mercury-Vapor Lamp.—A new form of high-voltage alternating current mercury-vapor lamp developed by Henri Georges of France is described in a recent issue of the *Revue Generale de l'Electricité*. In ordinary circumstances it is only possible to run such lamps on an alternating supply by the use of special electrodes. M. Georges, however, overcomes the difficulty by introducing neon gas into the tube, which is of quartz. The present lamp takes one ampere at 2,250 volts, but it is hoped to construct lamps taking up to 10 kw. and furnishing the most powerful source of ultra-violet energy known.

The National Research Council has entered into an extensive campaign to investigate the principles of insulation, a matter of vital importance to the electrical trade and to its consumers, we learn from *Electrical Review*. A meeting of the council's insulation committee was held recently in New York City, F. B. Jewett, chairman of the committee, presiding. For some time past the National Research Council has been endeavoring to formulate a practical plan whereby coöperation between the universities, the industries and the National Research Council might be accomplished in attacking the problems involved in fundamental research upon insulating materials.

A Five-thousand Foot Span, so far as is known the longest span in the world, is on the Knoxville Power Company's transmission line. The horizontal distance between supports is 5,010 feet. The difference in elevation is 208.5 feet. The conductors are 500,000-circular mill steel-cored aluminum cables which are under a tension of 19,000 to 20,000 pounds at 80 deg. F. Operation is at 150,000 volts.

Transatlantic Radio Telephony with 100 Watts appears to have been achieved by Hugh Robinson, a radio amateur of Keyport, N. J. Some time ago Mr. Robinson, while operating his radio telephone and transmitting phonographic music, was heard in Aberdeenshire, Scotland, or over a distance of 3,500 miles. It seems almost unbelievable that a radio telephone set operating on 100 watts should be heard over a distance of 3,500 miles, yet that is what the evidence in this instance would indicate.

Science

The Oceanographic Section of the International Union of Geodesy and Geophysics has been summoned by the Prince of Monaco to meet in Paris January 25, 1921.

The Cactaceae.—The second of the four volumes of the great work on the *Cactaceæ* by N. L. Britton and J. N. Rose, has been published by the Carnegie Institution of Washington.

A Polar Research Institute is to be established at the University of Cambridge, England. Funds for providing quarters, as an annex of the new School of Geography, have been given by the Captain Scott Memorial Polar Research Trust. The institute, says *Nature*, is to act as a center both for information on polar matters and for the working up of results, and is to include a polar library of bibliogical and geological specimens, and rooms for carrying on research.

The Action of Nitrogen Upon Platinum in the Presence of Nickel has recently been studied by Mr. F. Wolfers of Lausanne. In his report read before the Swiss Society of Physics he states that nickel is attacked by nitrogen at a temperature of about 300° C. in the absence of oxygen, forming a volatile nitride, which becomes unstable at 600° C., and that this nitride violently attacks platinum, causing it to become crystalline in structure and brittle. Consequently, it is inadvisable to employ thermo-electric couples of platinum in an atmosphere of nitrogen in the presence of nickel, at a temperature of more than 500° C.

Geographic Data for the United States, recently published by the Geological Survey, show that the gross area of the country is 3,026,789 square miles, including 53,015 square miles of water surface comprised in the Great Lakes, and the oceanic waters of the country within the three-mile limit. The southernmost point of the mainland is Cape Sable, Fla., which is 49 miles farther south than the southernmost point in Texas. The northernmost point is in Minnesota, the easternmost point is West Quoddy Head, near Eastport, Me., and the westernmost point is Cape Alva, Wash. From West Quoddy Head due west to the Pacific Ocean the country is 2,807 miles wide, while the shortest distance between the Atlantic and Pacific is 1,152 miles, between points near Charleston, S. C., and San Diego, Calif. The curved parallels and meridians of the ordinary map projections are responsible for widespread erroneous ideas as to relative latitudes and longitudes of places. Thus, few people realize that the island of Cuba, if transported due north would extend from New York City to Indiana, or that Habana is farther west than Cleveland, or that the Panama Canal is due south of Pittsburgh, or —perhaps most surprising of all—that Nome, Alaska, is farther west than Hawaii.

Aeronautics

Credit to Whom Credit Is Due.—Quite inadvertently we overlooked giving credit to Vickers, Limited, of Great Britain, in the article entitled "Building a Rigid Airship," which appeared in our issue of January 15th. Vickers have built several large rigid dirigibles and have quite equaled the German builders of airships, despite the fact that the latter have been doing this highly specialized form of work for many years.

Aviation School for Ecuador.—The Ecuadorian Congress during a recent session passed a law providing for the establishment of a school of aviation in Guayaquil and in Quito. The services of foreign experts are to be solicited, and funds are to be raised and appropriated for the maintenance of these schools. The public has contributed a large sum toward the purchase of airplanes, and one has already arrived at Quito.

The Navy's Planes for the Public.—To encourage the development of commercial aerial transportation and the training of civilians as airplane pilots for use in time of war, the Navy Department has authorized the sale of 125 coast patrol flying boats at about one-third cost price. The machines are of the "H.S.2-L." type, equipped with 400-horsepower Liberty motors capable of seating six persons. The planes are well adapted to mail, passenger and express service, forest patrol, timber scouting, surveying and pleasure purposes, according to Naval officials.

Expenses of Aerial Service.—In the course of a statement in the French Chamber recently, the Assistant Secretary of Aviation stated that the cost of upkeep of airdromes, hangars, repair shops, meteorological and wireless stations on the French portion of the Paris-London service was estimated at 20,000 francs per kilometer as against the cost of 50,000 francs per kilometer for a single line of railway. He thought that in the future the total cost of organizing an aerial service would be 10,000 francs per kilometer. On the other hand, he emphasized the difficulties due to present heavy charges on flying plant, the French calculation of the life of an airplane being 200 flying hours, which meant that about 3.50 francs per kilometer had to be added to the total cost of the service. This, however, he had hopes of seeing reduced.

The Caproni Giant.—From a recent issue of *La Gazzetta dell' Aviazione* we learn the following facts regarding the new giant "Caproni." The boat is built of three-ply, internally braced on the lines of the system used for railway carriages, and the three sets of planes are some 40 meters span with elevator ailerons, no other longitudinal control surfaces being employed. The eight Liberty 400-horsepower motors are mounted in tandem, four on the foremost and four on the rear triplane, in power eggs connected by two dummy fuselages. Control is by wheel with patent ball-bearings throughout, and is expected to relieve the single pilot from undue strain. Electric light signaling for conveying orders to the engineers has been adopted and the machine has been designed to fly on four engines only. Ninety-eight passengers are to be seated in the hull.

Wright Patents in France.—The French aviation industry seems to have its fair share of troubles, states *Flight*. Now that the "joy stick" litigation is settled, at any rate for the moment, the owners of the French Wright Patents have secured from the courts a writ of attachment on some 3,000,000 francs owing by the Minister of Finance to one of the French constructors. The writ has since been modified as regards 300,000 francs of the total which the firm requires immediately for development purposes.

High Altitudes and the Human Organs.—A peculiar account is given of two theories to account for flying sickness and of the experiments on which these theories are based. The French school, headed by Professors Bert and Regnard, holds that it is caused by shortage of oxygen, while the Italian school, led by Professor Mosso, maintains that shortage of oxygen does not of itself account for the sickness, but that collapse is due to lack of carbonic acid in the blood at high altitudes. Up to 9,000 meters, application of oxygen will overcome the sickness, but above that height a mixture containing carbon dioxide and oxygen is necessary.

Statement for the SCIENTIFIC AMERICAN by Samuel Gompers, President of the American Federation of Labor

An inquiry from the Managing Editor of the "SCIENTIFIC AMERICAN" for an elaboration of recent statements to the effect that labor proposed a new relationship between itself and scientists calls first of all for a proper stating of the basis for inquiry.

The situation is not that labor is just now opening its mind to something which it had previously refused to consider. A better statement of the situation is to say that a change in the conclusions of a great many industrial engineers, the scientists of industry, is making it possible now for labor to welcome co-operation with them and for labor to do its full share in developing that co-operation.

The organized workers fully understand that industrial processes can be materially improved, that the relation between workers and employers can be improved and that the human element in production can be made freer and more efficient by the establishment of proper co-operation between labor and the industrial engineer.

Of course, the co-operation of the employer also is necessary, since the position of the employer in industry is such as to make it impossible to make much progress if he chooses to stand in the road, unseeing and unbending.

It would be improper and unreasonable to say that great changes in industry are to be brought about quickly through co-operation with scientific minds in industry. It is proper and accurate to say that labor in its organized capacity is seeking to bring out the full value of the scientific mind and that it hopes through a better relationship with engineers to make possible marked improvement in the industrial life of the nation, ethically and materially.

Washington, D. C.,
December 23, 1920.

Samuel Gompers

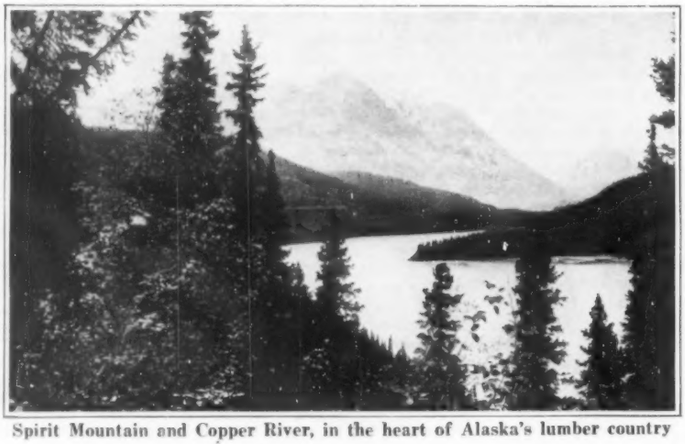
Paper from Alaska

The Prospects of a Permanent Supply of Pulpwood from Our Arctic Establishments

By James Anderson

THE eyes of news print users in all sections of the United States are now focused upon Alaska. To her, it now seems probable, will in the near future be assigned the task of solving one of the most acute problems of the present day—that of the paper shortage. Uncle Sam's forestry experts agree that in only one way can the shortage of news print be overcome and that is by the establishment of huge paper mills in Alaska. For the National Forests of Alaska contain resources sufficient to produce 1,500,000 tons of paper annually in perpetuity, and a huge paper industry in the territory is a certainty of the future.

Already a sale of 100,000,000 feet of pulp timber has been made, and a second sale of 1,500,000,000 feet, which will supply a great paper plant for more than thirty years, is now being arranged. The National Forests of Alaska offer paper manufacturers an ample supply of pulp paper, at low prices and subject to very reasonable and simple cutting requirements. The Forest Service is doing its utmost to develop this resource of the territory; it expects not only to make Alaska one of the great sources of paper for the United States, but to make the industry permanent, as it is in Norway. Paper manufacturers who go to Alaska can count upon an assured supply of raw material indefinitely.



Spirit Mountain and Copper River, in the heart of Alaska's lumber country

The timber depletion in the United States within the past few years with the resultant depletion in news print paper has been one of vital concern, not only to publishers, but to the entire populace of this country. Three-fifths of the timber originally in the United States is gone. The forests of the country are estimated at one time to have covered 822 million acres and to have contained 5,200 billion board feet of timber. Over two-thirds of this area has already been culled, cut over or burned. There are left today only about 127 million acres of virgin timber, 112 million acres of culled and second growth timber large enough for sawing, and 133 millions partially stocked with smaller trees of secondary growth.

Every year the United States is taking about twenty-six billion cubic feet of material out of its forests and growing about six billion feet in them. The result is that every year far more timber is cut than is grown. Even trees too small for the sawmill but upon which our future lumber supply depends are being used up today by the paper manufacturer three and one-half times as fast as they are being produced. The inevitable result of this is that lumber and pulpwood prices have risen to unprecedented limits. In March of last year average mill prices in the South and West had advanced three hundred per cent over those of 1914. The average advance on high grade hardwoods in eastern wholesale markets was from two hundred to two hundred and fifty per cent and even at these levels the demand was unsatisfied. Prices, indeed, were so excessive in the spring of last year that buying was to a very great extent automatically checked.

MUCH has been said, some of it in these columns, about the paper shortage. Obviously the situation is one which can be met only by an expanded supply or a contracted consumption. We do not find it convenient to contract our consumption and we are not at all confident that continental United States will be able to enlarge its production of pulp. There is, however, one factor of hope which is more often than not overlooked. The present article in our series on pulpwood and timber in general aims to show the place which Alaska may come to fill in our paper industry.—THE EDITOR.

The resultant shortage of news print has been such that many of those publications which did not suspend operations have been forced to triple the price of their product. The lumber shortage and high prices have seriously affected almost the entire population in still another way. It has checked building operations and the development of agricultural lands and needed improvements on farms. Besides many industries have been unable to secure their supplies of timber at any price.

In view of these facts it is small wonder that attention now turns upon Alaska to relieve the situation, with its enormous forests of rapidly growing trees suitable for pulp. A substantial development of the paper industry in this region, combined with the intelligent reforestation of pulp lands in the older regions, should settle the question of a paper shortage in the United States.

The National Forests of Alaska probably contain 100,000,000 cords of timber suitable for the manufacture of news print and other grades of paper. Under careful management it has been estimated that these forests can produce 2,000,000 cords of pulpwood annually for all time, or enough to manufacture at least one-third of the pulp products now consumed in the United States. It is easy to imagine what a tremendous help this would be.

The Alaskan forests also contain the second chief essential of a paper-manufacturing industry—water-power. While no accurate survey of this has been made, known projects have a possible development of over 100,000 horsepower; and it is estimated that a complete exploration of the National Forests in southern Alaska will increase their potential power to a quarter of a million.

At present western hemlock and spruce are the standard pulpwoods for the United States mills in the Pacific Northwest, the hemlock being consumed in greater amounts than any other single species. In 1918, 145,583 cords of hemlock pulpwood and 35,385 cords of spruce were consumed in Washington, Oregon and California.

Both of these trees are widely and thickly distributed about the Tongass region in Alaska. Western hemlock occupies about sixty per cent of the merchantable stand and is also being extensively used for pulp at a number of plants in British Columbia. Spruce forms about twenty per cent of the stand, and varies greatly in percentage of mixture, from pure stands of ten acres or less to stands in which it is practically absent. From these two woods the following papers are made: Manila, cartridge, sheathing, book, label, writing, and related papers. These facts show that the two principal species of Alaska timber are both commercially suitable for mechanical and sulfite pulps, and the papers that are usually made from them.

Not a stick of timber for commercial pulpwood has as yet been cut in Alaska. The 400,000,000 feet of timber sold and cut to date from the National Forests in Alaska has been made into products such as piling, sawlogs, and shingle bolts. The logging methods have been developed from "hand logging," in which the trees were felled so that they would fall directly into the water or could be rolled in by hand, to steam donkey logging, the donkey being mounted on a raft and "beached" at high tide, yarding directly into the water. Later two donkeys have been used, a yarder and a roader. In the water the logs are boomed and towed to the sawmills.

The logging heretofore has been of comparatively large or selected timber. Pulpwood cuts will have larger yield per acre, as smaller timber will be cut. It is doubtful if the present system of logging is the best and cheapest that can be devised for pulpwood logging on an extensive scale. An overhead system seems to promise one solution of the problem. In this system a number of small logs could be brought to the water with a "choker." Gravity chutes might be profitably employed on the steeper slopes. For material farther back it might be necessary to put in logging railroads. No two logging units, however, would present the same

(*Continued on page 75*)

A Sitka spruce forest in Southern Alaska

Group of pulp-timber trees in Nakat Inlet

Every Automobile Its Own Elevator

By Robert G. Skerrett

ONE of America's biggest problems is to eliminate lost motion in every phase of transportation—using that term in its widest sense. It costs money to move anything any distance, for the work involves an expenditure of time and effort. Whenever commodities are shifted from one conveying medium to another there is a break that halts for the nonce the steady flow of the goods. Trite as these facts are, and well known by every traffic expert, it is doubtful if the average citizen realizes how much more he has to pay in the long run because of the interruptions in the transportational tide.

The automotive vehicle is doing much to bridge the gap between terminal facilities; it is speeding up the transfer of merchandise where formerly the service limped; but the great majority of owners of cars and trucks have not yet awakened to the full potentialities of these vehicles as carriers. In industrial and business circles, for instance, it has occurred to comparatively few that it is entirely practicable to utilize the hill-climbing powers of the truck and car to link directly the floors of shops, factories, warehouses, garages, etc., with the public highways, and thus to avoid dependence upon the elevator as an intermediate agency.

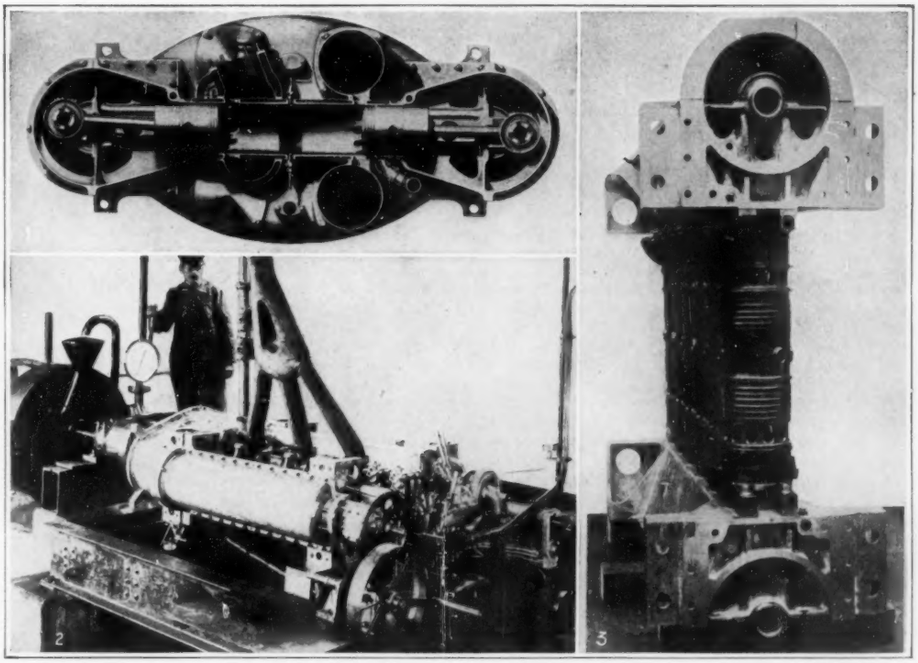
Take the general run of department stores, manufacturing establishments, and bustling warehouses, and what is the usual procedure in getting wares, products, and freight broadly in and out of the buildings? Well-nigh invariably, inter-floor movement is effected by means of more or less capacious elevators. These lifts use a platform on the ground level as the link between themselves and the delivery wagons and trucks that bring in or take away the various commodities involved. The mind instinctively pictures the series of handlings necessary to deal either with outbound or arriving goods.

Without any intention to underestimate the elevator, it should be plain that much might be saved if every story could, in effect, be just as accessible to the motor vehicle as the ground floor, and this without the help of the freight lift. Why not make it practicable for trucks and delivery cars to climb directly to any floor of a business or industrial establishment, there to load or unload as the case may be? This can be done.

Of course, many of us are familiar with those inclined extensions of the street, commonly termed ramps, which make it possible for motor vehicles to get in and out of the basements or to reach one or more of the floors of a structure above the ground level. This means of ingress and egress has been adopted for a goodly number of garages, and has served to obviate the installation of elevators. While a step in the right direction, these ramps have compelled sacrifices in revenue-making space that have minimized the economies promised by the abandonment of the lift. Let us make this clear.

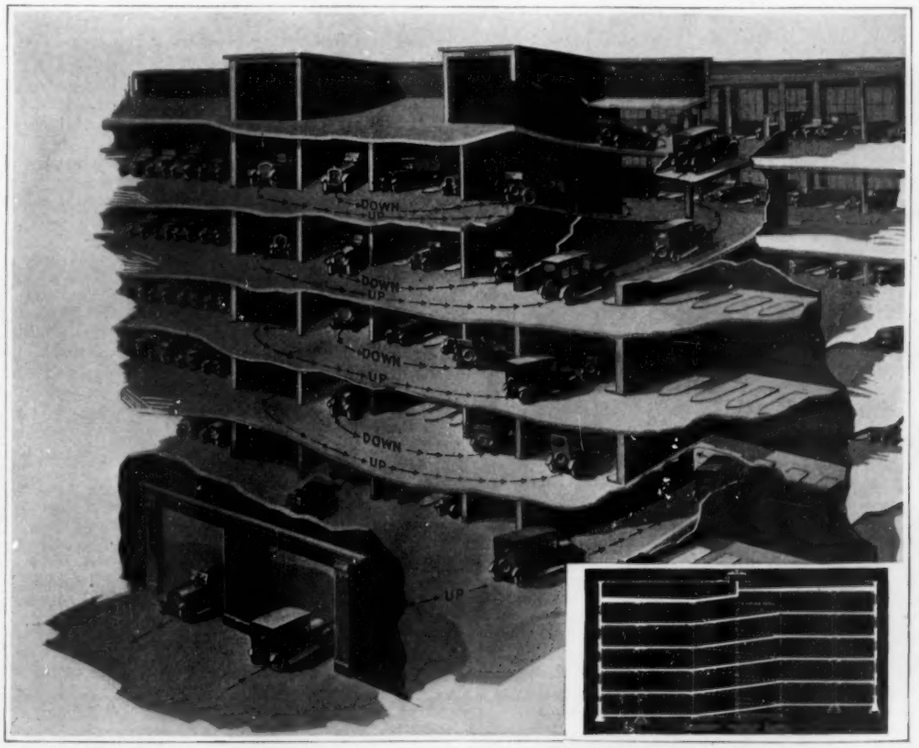
Where the inter-floor space has an average height of 12 feet, for instance, the gradient of the ramp must not be too steep to make it easy and safe for the motor car or truck to climb or to descend from floor to floor. Accordingly, an ordinary ramp, with its end turns, calls for a linear span of approximately 140 feet, of which at least half is required for the ramp alone. Where the ramps are carried to succeed-

(*Continued on page 75*)



1. Section through the engine. The pistons move in and out together. The intake ports are seen at the right and the exhaust ports at the left. The big openings above and below the former are the passages which deliver air from the blower to the intake ports. The spark plug is above the combustion chamber, with the fuel injection pipe directly beneath it. 2. The engine on the test stand. The cranking mechanism, water pump and magnetos are seen at the right end; the peculiar stick-up pipe is the exhaust. 3. The engine partly assembled, showing cylinders and upper half of crankcase

Junker engine of modified Diesel type for airplane use



Sectional views of two garages with staggered floors, equipped with a central motor ramp in place of an elevator. The larger seems practical also for heavy inter-floor movements in warehouses, etc.

A Near-Diesel Engine for the Airplane

By Harold F. Blanchard

NOTHING could be more interesting, to those familiar with internal combustion problems, than the news that the Diesel engine has been successfully applied to airplane practice. The new engine has been installed in a German monoplane and was designed by Professor Junkers. The advantages claimed are those of low weight per horsepower, increased reliability, higher fuel economy, greater simplicity, safety against fire, and perfect balance.

In order to appreciate fully the features of this engine it is necessary to explain the Diesel engine principle. In the true Diesel neither carburetor nor ignition is employed. The compression is extremely high. Instead of employing a maximum compression pressure of 80 to 100 pounds as in the ordinary designs with which we are familiar, compressions as high as 600 or 700 pounds are employed. The extreme compression raises the air to a very high temperature so that when a carefully measured quantity of fuel is injected into the cylinder at just the right moment the air is so hot that the fuel immediately takes fire. "Throttling" of the engine is obtained by varying the quantity of fuel delivered. The injection of the fuel, by the way, occurs in the instant just before the piston reaches top dead center. The fuel is immediately vaporized by the excessively hot air and is thoroughly distributed throughout the combustion chamber almost instantly. From this consideration of the subject it is plain that the Diesel engine is a type in which the compression pressure is constant whereas in the ordinary type used in airplane work the compression pressure is varied according to the demand by opening and closing the throttle.

When Diesel engines were first produced they attracted considerable attention because of their unusual economy; no type of prime mover has yet been devised that approaches the true Diesel here. This economy is due to the fact that a constant compression cycle is more efficient than a variable compression cycle, and also because efficiency increases with the compression pressure which is very much higher in the Diesel than in other types.

The Diesel was long considered out of the question for use in automobiles or airplanes because of its extreme weight. It was necessary to make the cylinder very heavy because of the high pressures generated in it, and the reciprocating parts had to be strong to stand the high acceleration forces developed.

The Junkers Diesel engine is a modification of the true Diesel in that high but not extreme compression pressures are used (about 210 pounds); and because of this reduction in pressure jump-spark ignition is used to ignite the charge. It is a six-cylinder two-cycle, with

(*Continued on page 79*)

The Case for the Steam Locomotive

Improved Efficiency a Possible Alternative to Railroad Electrification

By Charles Frederick Carter

HAS the steam locomotive reached the limit of economic development? Is it about to be superseded by electricity?

Taking the last question first because it is the more easily disposed of, the fact must be borne in mind that electrification of the railroads would involve the building of immense power plants, transmission lines, conductors, shops, machinery and locomotives—practically the rebuilding of existing facilities. Statistics compiled by the Bureau of Railway Economics show that in the fourteen years from 1921 to 1934, inclusive, debts aggregating more than ten billion dollars will fall due and must either be paid by the railroads or refunded. As the railroads are prohibited by law from earning returns equal to those yielded by other forms of investment, refunding is not likely to be simple or easy. If it is going to be difficult to meet outstanding obligations, how are the railroads to raise the enormous sums which would be required for electrification of even the principal lines, superadded to financial requirements for other and urgent improvements?

Fortunately for the country railroad managements are not called upon to face this problem because the continuous improvement of the steam locomotive which has effected economies to offset so much of increased operating costs in the past still offers attractive possibilities.

A great many mechanical engineers and other scientific specialists have been, and are still, devoting all their time to the study of locomotive problems. The results achieved are truly remarkable. Only a few years ago locomotives were built as large as clearance limits would permit with boilers of fifteen hundred horsepower. Clearance limits have not been increased but the capacity of boilers within those limits has been doubled. It may be of some help in appraising this truly remarkable feat of compressing great power into small space to bear in mind that a stationary steam power plant of 3,000 horsepower would have half a dozen standard water tube boilers which, with the engines and auxiliaries supplied with steam, would occupy a ground area of ten thousand square feet or more and a height of forty feet as compared with the locomotive's length of 100 feet, extreme width of 10 feet 3 inches and extreme height of 15 feet.

The average locomotive of 1,500 horsepower limit in size burned from six to eight pounds of coal per horsepower hour; representative types in large numbers are in service today developing a horsepower hour on three pounds of coal or less. Some of the best designs use as little as two and a half pounds of coal per horsepower hour. These results have been made possible in part by the perfection of the feed-water heater which, by utilizing waste heat for raising the temperature of the water as it enters the boiler, to that extent decreases the amount of heat to be supplied by burning coal. Other factors are the superheater and the more liberal design of the boiler made possible by the trailer truck. Brick arches and other details have so increased the efficiency of the boiler that 70 per cent of the heat units in the coal burned in the firebox are transformed into effective power in the boiler.

One of the possible future developments is in fuel and its efficient stoking. Fuel involves not merely quality and the means of handling and burning but also the problem of supply. If there were an unlimited supply of oil it would be a simple matter to transport and store supplies, to transfer from the storage tank to the tender and to pipe from the tender to the firebox and thus solve the problem of stoking and efficiency of combustion. But the world's oil supply is too scanty to permit its use as locomotive fuel except in a temporary and strictly limited way.

It is, therefore, necessary to consider what can be done with coal, which varies so greatly in physical and caloric attributes. It would greatly simplify matters if all coal for locomotive use were of the highest quality, free from sulphur and other impurities. But it would not be economic to use the finest grades of coal for locomotive fuel exclusively and thus deprive other consumers whose requirements are more exacting.

It has been suggested that the inexorable necessity of conserving the supply of fuel will compel us to develop on a commercial scale a process of treating coal which will provide a standard quality of fuel and save the other intrinsic values for other commercial uses. The gases ordinarily freed in burning coal as fuel may be distilled and put in solution for use in automobiles and other internal combustion engines, while the coal tar products can be saved for their myriad uses in industry. It has been alleged that the intrinsic value of a ton of ordinary Pennsylvania coal is $25; and that its value for fuel is only one-fifth of this price. The four-fifths irretrievable lost when the coal is burned as fuel, if properly conserved by processes already understood would yield the producers a handsome profit and provide locomotive fuel at a small fraction of present prices.

The automatic stoker has not yet attained perfection. By providing a combustible of the type indicated the difficulties in the way of efficient mechanical stoking will largely disappear.

Another promising field for improvement is in thermal efficiency; that is, the ratio of heat units converted into steam in the boiler to the total contained in the combustible burned in the firebox. At present the best practice transfers 70 per cent of the heat units in the coal into the steam in the boiler. Present progress encourages the hope that the standard may be raised to 80 per cent.

In this connection it must be borne in mind that there is a marked difference between the thermal efficiency of the boiler and of the engines of the power plant. Disregarding the small amounts of steam used by accessories such as the air pump, stoker engine, etc., and confining the comparison to the main power plant of the locomotive, the ratio of work done at the drawbar in terms of energy compared to the heat units delivered in steam at the top of the valve chest is 10 per cent. A part of this loss is inevitable, regardless of whether the steam engine is mounted in a stationary plant or whether on the frame of a locomotive. Mechanical friction is necessarily greater in a locomotive because of the limitations in weight and dimensions. The average steam locomotive loses about 17 per cent of efficiency because of friction and its own weight.

By far the greater loss is the latent heat of vaporization. It takes one heat unit to raise a unit of water one degree in temperature from 211 to 212, and one heat unit to raise temperature from 213 to 214, for instance. But it takes 700 heat units to change water into steam. When the steam is exhausted from the locomotive and is condensed into vapor about 700 heat units are surrendered to the atmosphere. About 40 per cent of this latent heat of vaporization is literally thrown away because no way of recovering it now exists on the locomotive. In stationary power plants where abundant ground area and water supply are available to build condensing plants and even on shipboard it is possible to recover a large part of this latent heat. A locomotive with similar facilities would probably be as long as an ordinary suburban train and of course, entirely impracticable. Present knowledge affords no way to recover this very large amount of wasted energy, yet it is within the bounds of future possibilities that a way may be found. The suggested possibilities of increasing thermal efficiency from 70 to 80 per cent are to be realized by the proper combination of known resources, such as improved superheaters, feed water heaters and perfected combustion.

Great mechanical improvement has been made in recent years. Electric welding has practically abolished the trouble from leaky flues. Firebox surfaces are now stayed with flexible staybolts. Outside valve gear readily accessible for repairs is now the standard. Ingenious devices for taking up wear in crossheads, wedges and other parts have come into extensive use. Mechanical stokers have made possible the introduction of locomotives too large for efficient firing by hand. There are pneumatic firedoors, electric headlights and many other devices unknown a few years ago. Still, the limits of possibility in mechanical development do not appear to have been reached.

One of the most recent improvements is known as "The Booster," which by utilizing the idle weight of the trailer truck and the surplus steam in the boiler at starting adds 20 to 35 per cent to the power of the locomotive at starting and enables it to "pick up" a heavy train very much more rapidly than would otherwise be possible. There are numerous other mechanical devices now in process of development which, when perfected, will still further enhance the efficiency of cylinders and machinery.

Mechanically the tendency in the last twenty years has been to increase the weight of locomotives very greatly. This tendency, however, has its limitations and this introduces the factor of capital efficiency; that is, the ratio of capacity for doing work to the amount of investment. Weight has a direct reaction upon the investment in track, structures and all facilities with which the locomotive comes in contact. There is a point beyond which it ceases to be economical to strengthen bridges and increase the weight of track structure. A locomotive materially heavier than a given standard might be theoretically far more economical than the standard but if its adoption involved the reconstruction of the whole railroad to stand up under the increased weight it would hardly be deemed a wise investment.

By mechanical refinements already in process of development and increased thermal efficiency known to be attainable it will be possible to increase the capacity of the steam locomotive enough to take care of the increasing volume of transportation for the immediate future. The question of electrification will then be thrown back where it belongs—it will rest on the ability of electricity to compete with steam, in capital expenditure and in operating economy. There will be less talk of electrification to meet the "breakdown" of steam.

IT seems to be generally accepted today that the age of the steam locomotive is drawing near its close, and that the immediate future will witness electrification on a scale that can only be characterized as general. We suppose that no partisan of the steam engine will deny that there are places where the conditions of traffic, grades and water supply combine to make electric railroading cheaper than the use of steam. But Mr. Carter calls our attention to the fact that in the general case, apart from any such extraordinary circumstances as dictated the St. Paul electrification and the use of current in the suburban territory adjacent to our large cities, a very good brief may be put in for the steam locomotive. We are glad to give him the space in which to develop this brief, and to tell why he does not believe that electrification on a nation-wide scale is either imminent or necessary or even advisable.—THE EDITOR.

Wireless Telegraphy at Danzig

ACCORDING to the Danzig press, the Danzig telegraph office has recently installed a wireless press receiving station. These receiving stations, of which there are said to be about 120 in Germany, receive, for transmission to newspapers, press news distributed by wireless by the press services. In addition, the stations receive commercial news of the Bureau of Foreign Commerce in Berlin, intended for chambers of commerce, and also weather reports. News is sent out by the main station in Köningsmusterhausen.

The Danzig telegraph office is now operating four wireless stations: A station for the domestic telegraph service of the German wireless system; a coast station for communicating with vessels; the wireless press receiving station referred to above; and a special receiving station maintained by the *Danziger Zeitung*, a local newspaper, for its own messages.

The Polish authorities also possess their own wireless station, situated in the port district at Danzig-Neufahrwasser and used largely for communicating with vessels bringing government supplies. According to the press, the Polish station was specially authorized by the high commissioner and is subject to certain regulations in order to prevent interference with the operations of the Danzig, German, and British naval stations. For instance, the Polish station may communicate with Warsaw only between 1 and 3 A. M., and its conversations with vessels at sea must be confined to 10 minutes.

Developing One Million Horsepower from Tidal Energy

A Government Scheme for Distributing 500,000 Electric Horsepower Generated in a Barrage Across the Estuary of the Severn

IT is noteworthy that the first attempt to utilize tidal power for industrial purposes should be planned on such a scale of magnitude, that the resulting power plant will far exceed any of the world's existing hydroelectric installations. The tidal hydroelectric scheme for utilizing the energy of the 30-foot tide, which ebbs and flows in the estuary of the River Severn, is daring in conception and proves that its sponsors have the courage of their convictions. The huge dam, 3½ miles in total length, is to be built across the mouth of the Severn estuary, where the distance in an airline from shore to shore is 2½ miles. The 30-foot tide will flow through inwardly-opening sluice gates and will flow out to sea through a vast number of water turbines built within the dam itself.

In respect to its unprecedented magnitude this venture of British engineers will be in the same class in the field of hydroelectric development as was the construction of the great bridge across the Firth of Forth in the field of bridge engineering. That the undertaking is no mere paper scheme is proved by the fact that it is being done by the Government itself, the plans having been worked out by the Civil Engineering Department of the Ministry of Transport.

The Severn is particularly suitable for such a work because of its great range of tide, 30 feet at its maximum, and the fact that the estuary is of large capacity. Also, the location is geographically well placed in relation to the industrial centers of Great Britain. An interesting fact which explains why this work is being undertaken by the Ministry of Transport is that the predisposing motive for the whole scheme was the necessity for improving railway communication between South Wales and the rest of the country. For some years there has existed at the proposed location of the dam a railway tunnel beneath the Severn, but its grades are heavy and it has no provision for road traffic, which, to get across the river into South Wales, must make a detour of some 50 miles by way of the city of Gloucester. The project is to build a vast low-level railway viaduct and roadway which will quadruple the capacity of the Great Western Railway Company's line between Bristol and South Wales, and it is out of the railroad and highway bridge proposition that the proposal to construct a dam for hydroelectric power has developed. The topographical features are suitable for dam construction. Near the center of the viaduct there is a deep channel with a rock formation on either side of it, and because of the excellent foundations thus provided, it was decided to follow the general line of the rocks and build the dam in the irregular form shown in our drawing. The dam itself will be built of reinforced concrete, and its cross section will be of generous dimensions, sufficient to permit of housing the water turbines and generators within it.

There will be two separate power plants. First, there will be the turbines and generators in the dam itself, which will have a combined capacity of over one million horsepower and will be in operation during the periods when the difference in level between the water above and the water below the dam is sufficient to run the turbines efficiently. It will be understood that these periods must necessarily be intermittent; moreover, because of the procession of the tides, they will vary from day to day. Hence, in order to secure a continuous output of power, it was necessary to provide an auxiliary plant which should run when the main plant was idle. This will be secured by building a dam across a valley which leads into the River Wye, a tributary of the Severn just above Tintern Abbey, and forming an auxiliary reservoir behind it.

Since the total amount of electrical energy to be sent into the line for distribution is 500,000 horsepower, it is evident that there will be a surplus energy produced by the total million horsepower plant of the main dam, and this surplus current will be utilized in an electrical pumping station in the Wye Valley which will deliver water from the Wye to the above-mentioned high level reservoir. When the tide falls to a level at which the turbines in the main dam cannot operate, the auxiliary turbo-electric plant of the Wye River will be operated by utilizing the waters which have been already pumped into the high level reservoir.

It is proposed to supply for industrial and lighting purposes 500,000 horsepower for ten hours of the day. From the above description and from our plans, it will be understood that there are two huge power stations, one in the dam capable of generating a million horsepower, and one on the Wye of 500,000 horsepower capacity, so that the total installation will reach 1,500,000 horsepower. During portions of the day, one or other of these plants will be idle, but for a part of the day, depending upon the state of the tide or the relation of the level of the water above and below the dam, the two plants will be working in parallel. It should be mentioned that the water from the Wye will be pumped into the high level reservoir through a tunnel 40 feet in diameter, which will be driven for over a mile through solid rock.

The ebb tide of the Severn runs for a longer period than the flood tide; consequently, the turbines in the main dam can work for about seven hours, the plant being idle for about five hours. The main turbines will begin to work under a head about five feet, and about the middle of the seven-hour period, it will increase—on spring tides—to about 30 feet.

Mixed-flow turbines with runners 10 feet in diameter will be used, since the speed, due to variation in head on the turbines, will be from 40 to 80 revolutions per minute. The generator will be driven through a helical gear with a ratio of 7½ to one, so that the generator speeds will be between 300 and 600 revolutions per minute. There will be a maximum rate of change of head of 10 feet increase or decrease in the hour. Current will be delivered at a voltage of 525, and it will be passed through rotary converters and static transformers for transmission at 60,000 volts.

The energy will be distributed to four different centers; first to the immediate locality of the power plant for the use of the industries which will grow up around the banks of the river; secondly, through the great

(*Continued on page 79*)

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

St. Paul Claims Its Own

To the Editor of the SCIENTIFIC AMERICAN:

The lift bridge illustrated and described in your issue of December 11, 1920, which your correspondent claims is located in Minneapolis, is in fact in the center of St. Paul and is not within five miles of the city limits of Minneapolis. Minneapolis always claims that everything of interest or prominence in St. Paul is located in Minneapolis. St. Paul might with equal propriety claim that the beautiful concrete bridge in Minneapolis is located in St. Paul.

St. Paul, Minn. SPENCER E. SMITH.

To the Editor of the SCIENTIFIC AMERICAN:

If you will get the envelope which this letter came in out of the waste basket, you will, no doubt, be surprised to see that it is postmarked Saint Paul. Strange as it may seem, we do not depend on Minneapolis for our letters, but have a postoffice of our own.

We also have several department stores, a few hotels, and some theaters. We have our own street car system. We have nine railroads which stop here on their way to and from Minneapolis. We have our own city council, our own mayor, and our own representatives in Congress.

I will not go so far as to say that we are a city, but we have 235,000 people, and in time these figures may swell to such proportions that we will be known as the city of Saint Paul, and not as a suburb of Minneapolis.

In case I have not made myself clear, will say that any railroad bridge operating as an elevator or otherwise, which crosses the Mississippi River at Saint Paul, belongs to Saint Paul and not to Minneapolis.

I am not a subscriber to your magazine, and after hearing about your issue of December 11th, have no desire to become one. CLARENCE I. TAYLOR.

St. Paul, Minn.

[*We are sorry that our Minneapolis correspondent should have displayed what we understand is a rather common failing of his fellow-townsmen—an inability to appreciate the fact that the Minneapolis city limits stop some five miles short of St. Paul. For our own part in the matter we feel less apologetic than usual where we have printed something that turns out not to be so. Strange and incredible as it may appear to Mr. Taylor, the editorial vision does not extend to the banks of the Mississippi, and for what goes on west of Jersey City we are actually dependent upon the written and pictured word of others. There doesn't seem to be anything about the bridge pictures submitted to us to suggest that the contributor was outside the facts in placing his bridge in Minneapolis—they have railroads there, and they have the river. When our contributor placed it at Minneapolis, we really think it would have been just about as sensible for us to suspect the bridge of being at Omaha or Memphis as to imagine that it might be at St. Paul.*—THE EDITOR.]

The Foundation of Geometry

To the Editor of the SCIENTIFIC AMERICAN:

If I have rightly understood your article on the parallel postulate it would seem that you desire to convey the impression that measurements should enable men to determine whether the space they live in is Euclidean or non-Euclidean.

If this is really your stand I would like to make the following remarks:

It has been suggested that if space were Riemannian or Lobatchewskian the parallax of a distant star would be negative in the one case, or always finite in the second case. This would undoubtedly be true, providing we had assumed previously that the rays of light defining the angle of the parallax were geodesics.

But were we to assume that rays of light do not travel along geodesics we would be just as justified in assuming that space might be Euclidean.

The assumption we would adopt as to the nature of the trajectory of light would be dictated by convenience. Our conclusions as to the nature of Space would then themselves be dictated by convenience.

The acceptance or the rejection of the parallel postulate would simply amount to a definition of the way we intended to divide up the abstract concept of Space.

In the same way we might determine in advance whether a length should be divided up into meters and centimeters—or yards and feet, etc.

For this reason the parallel postulate is incapable of demonstration since it is nothing but an arbitrary definition. Until such time as we can prove that one line is a geodesic and another line is not a geodesic we can never discover by measurements the nature of Space; and until we can prove the nature of Space we are unable to determine what is a geodesic and what is not a geodesic; so we are turning in a vicious circle of argumentation.

When, therefore, we say that Space is Euclidean or non-Euclidean, we simply mean that we find it more convenient to measure it Euclideanly or non-Euclideanly. We will naturally choose the simplest method, taking into consideration the phenomena we come in contact with.

Until recent years the Euclidean way appeared the simplest on account of the large number of bodies in this universe whose movements coincide with more or less precision with those of indeformable solids. With the most recent discoveries of science, however, Einstein has shown us that taking everything into consideration the Lobatchewskian way was the simplest.

Calgary, Alta. A. d'ARNO.

[*The geometry of a given physical system may usually be made Euclidean or non-Euclidean at pleasure by proper manipulation of the dimensionality or proper arbitrary choice of the elements. The most familiar instance of this is the geometry of the spherical surface, which when we meet it in school is made to fit into the Euclidean three-dimensional structure, but which is simpler scientifically if not pedagogically when we look upon it as a two-dimensional Riemannian geometry; and we can build up a valid geometry of ordinary three-space, using other elements than point and line—point, circle and sphere, for instance—to give us a non-Euclidean structure. But after we have selected the elements which we are going to use in the geometry of space, we shall be able to determine what kind of a geometry they lead to.*—THE EINSTEIN EDITOR.]

A Daring Ship Design

Concrete Tankers Cast in Sections from Sliding Forms

By Ralph Howard

ANOTHER "kink" in shipbuilding originated during the war has demonstrated once more that ships do not always have to be built according to time-honored methods. Before the tremendous impetus given to shipbuilding in this country by the war needs, with the resulting development of new ideas, if we had been told that some one had proposed an oil tank ship built in sections by means of the ordinary sliding forms such as are used in the construction of the familiar concrete grain bins, these forms to be afterward joined together to make the finished ship, we might well have laughed at the apparent absurdity of the suggestion.

The sideways launch of the first of the sectional concrete tankers

But in the successful launching of the 2,000-ton oil tanker "Durham" at Aransas Pass, Texas, recently, the seemingly impossible thing has been accomplished; for the vessel was built in just the manner outlined.

This unique tanker will be operated in carrying oil from Tampico to Aransas Pass, and its record in service will be watched with great interest because of its unusual design. A sister ship is nearing completion on the ways, and upon the success of these two vessels hinges the construction of a fleet of sixteen others. The boats are somewhat similar in outward appearance to the whaleback type of freighters used on the Great Lakes for transporting ore and grain, but that is as far as the similarity extends.

The builders of this craft secured permission from the Emergency Fleet Corporation, during the latter period of the war, for the construction of a fleet of reinforced concrete oil barges, and the design finally selected was one which possessed features that indicated considerable economy in construction as well as greater efficiency in operation than other types of barge design that had been considered. The original design for a tow barge was later changed to self-propelled tankers.

The body of the vessel consists of two interlocking cylinders connected at top and bottom by flat slabs, which form the deck and keel sections. The interlocking of the cylinders provides a passageway fore and aft through the hull that also serves as a buoyancy chamber from bow to stern. Bow and stern sections are ship-shape. The former affords space for chain lockers, stores, etc., and the latter for the internal combustion engines which drive the twin-screw propellers.

The oil cargo is carried in the main portion of the cylinder on each side of the central passageway, while the smaller chambers below the latter connect the oil compartments with the cargo pumps and the similar chambers above act as air-relief pipes connecting the oil compartments with ventilators at bow and stern.

The quarters for officers and crew are in a concrete deck-house amidships and the wheel-house is also located at this point. It is intended that the vessel shall carry twenty-five men.

The major portion of the hull is straight (210 feet long), divided into 7 sections by transverse bulkheads; thus there are seven compartments on either side of the buoyancy chamber. The total capacity of the tanker will be 14,000 barrels of oil.

Each 30-foot section was built in a vertical position by the use of sliding forms which are raised continuously by patented jacks, so that there are no joints or lines of cleavage in the individual sections. This method of construction has been used for a number of years in the construction of concrete grain elevators, but the present is the first attempt to use the system for concrete ship building.

Since these forms can be raised free of the completed sections, they are used again for building additional sections as required, thus securing great economy in construction. Each finished section was lowered by jacks on to steel carriers or "creepers" operating on railroad rails set in a concrete foundation platform 1,100 feet long, which was built alongside the launching ship to provide for the construction and assembling of the vessel. The section was moved forward into a tilting cradle, carried by shafts running through concrete supporting columns, and turned to a horizontal position, then placed on wooden cradles carried on the "creepers" mentioned and moved to final position in the ship.

Each cylindrical section was molded several feet short of the thirty foot length, but the rods used for longitudinal reinforcement projected beyond the upper end and were joined with similar bars of the adjacent section when placed horizontally in position on the ways.

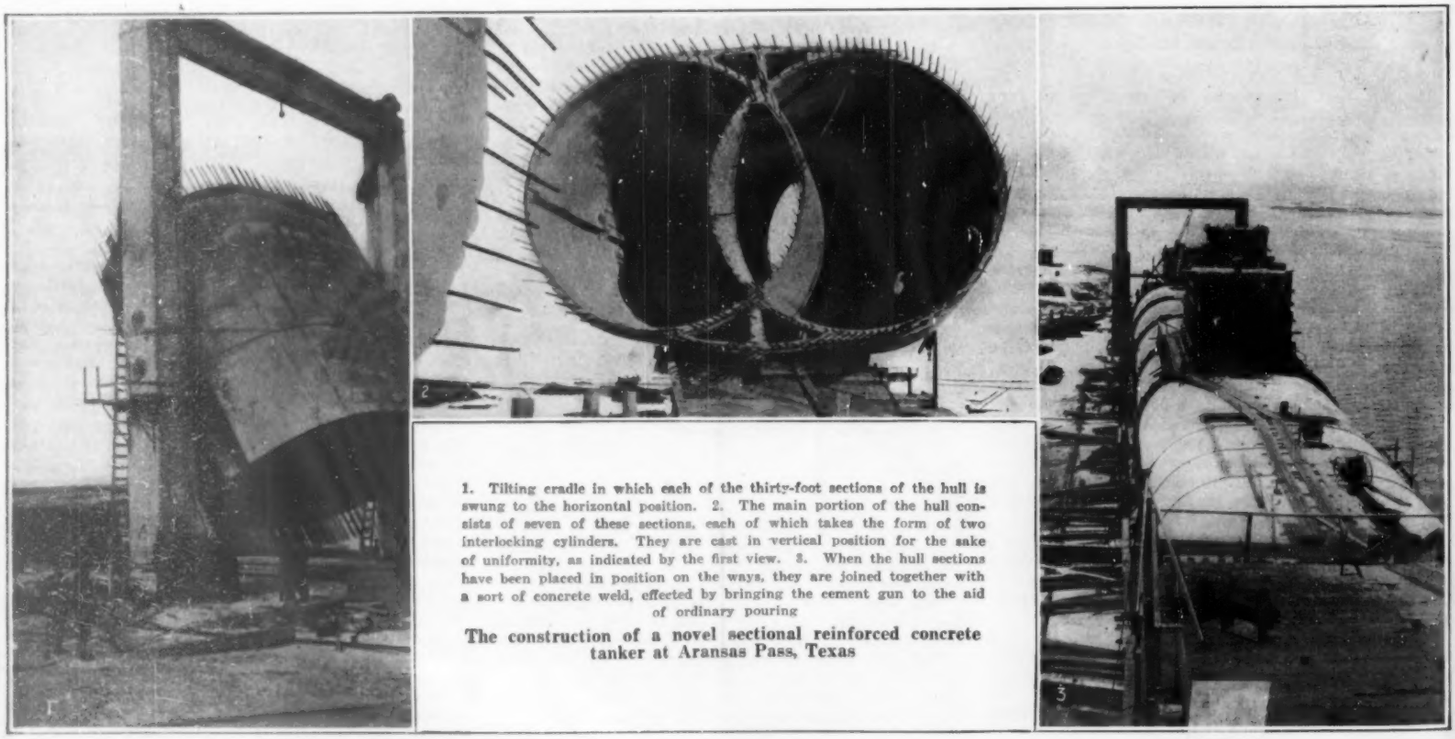
The open joints formed between sections were concreted by shooting each edge of the joint with a cement gun to obtain a good bond and at the same time filling with concrete the space between.

The stern section was built in fixed forms in its proper position on the launching ways, but the bow section was built and moved into position after all of the cylindrical sections were placed.

Construction of the first two tankers of this novel design was delayed by the terrific Gulf hurricane of September 14, 1919, which destroyed the construction buildings and much of the supplies and equipment, but the concrete hull sections finished at that time were not damaged. In spite of this discouragement, the work was resumed and, though greatly delayed, has been steadily pushed to a conclusion.

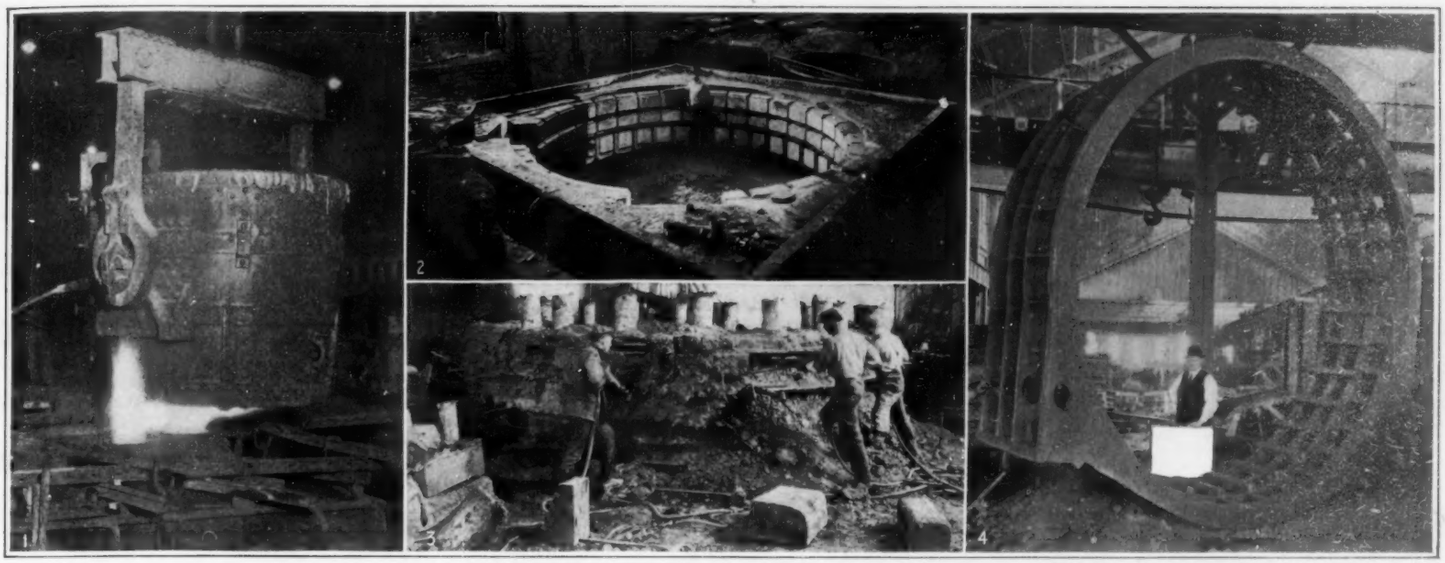
The concrete used in building the tankers was a

(*Continued on page 79*)



1. Tilting cradle in which each of the thirty-foot sections of the hull is swung to the horizontal position. 2. The main portion of the hull consists of seven of these sections, each of which takes the form of two interlocking cylinders. They are cast in vertical position for the sake of uniformity, as indicated by the first view. 3. When the hull sections have been placed in position on the ways, they are joined together with a sort of concrete weld, effected by bringing the cement gun to the aid of ordinary pouring

The construction of a novel sectional reinforced concrete tanker at Aransas Pass, Texas



1. Ladle of molten steel being poured into the sand mold. 2. Mold partly finished. To complete the mold forty-seven cores are required for forming the hollow or lattice-like portions of the casting. 3. Cleaning the casting after it has cooled in the mold and has been removed from the flask. 4. The final casting, cleaned and with heads removed, ready for annealing

Four steps in the production of huge steel castings for the main frames of battleship electric motors

Casting Steel Motor Frames for Our Electric-Drive Battleships

ONLY comparatively recently have American battleships been propelled by electricity instead of steam. To do this involved radically new machinery and equipment, some of it of extraordinary large size. According to present plans all new battleships and cruisers are being equipped with electrical driving mechanism.

For the propulsion of such massive ships by such power, the motors must be very large. To meet the unusual stresses or strains the castings that go to form the motor frames must be of steel, not iron.

One of these large main frames is shown in one of the illustrations and an idea of its magnitude is obtained by comparison with a man. The production of such a casting, which in its finished state weighs 25,000 pounds, is very difficult. It is made or poured in a sand mold which is made in a large flask in a large pit or hole in the ground. The flask is 18 feet square and 5 feet 6 inches deep. To complete the mold 47 cores are required, the cores forming the hollow or lattice like portions of the casting. One illustration shows a mold partly finished while another gives an idea of the pouring of the casting with a ladle of hot steel, the immense flask in the pit which forms the mold being also visible. The final casting after it has cooled in the mold and has been removed from the flask, ready for cleaning and about to be cleaned is pictured in another view. The many protrusions are the various risers or heads of steel which are necessary to all steel castings and which feed the solid portions of the casting as it cools and contracts.

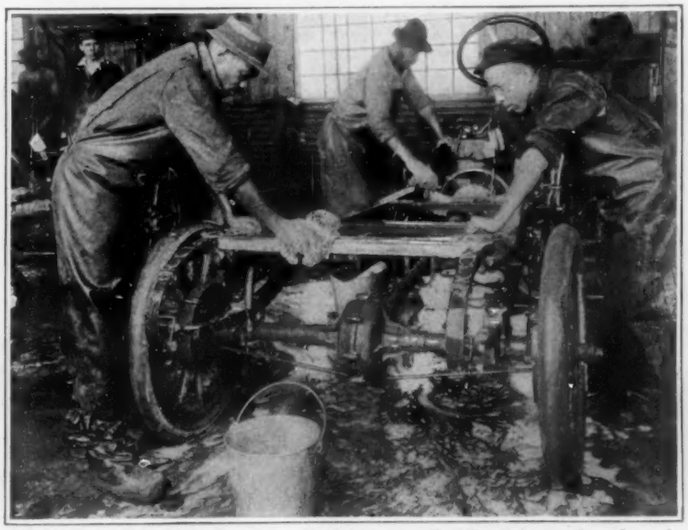
The final casting, when cleaned and the heads removed, is annealed in a large annealer and then shipped in specially constructed cars. The completed casting is beautiful as steel castings go, and is about 17 feet in diameter and 4 feet 6 inches high. The castings are being made by a large steel casting company.

Dyewoods in Demand

MANUFACTURERS of natural dye extracts are having a difficult time at present, they state, in obtaining satisfactory supplies of the basic raw woods which are obtained from foreign lands, principally the Indies, both East and West. They state that importers are not bringing in sufficient quantities of these woods to meet the needs of extract makers, despite the fact that prevailing prices are virtually four times higher than the prices prevailing in 1914. Importers, on the other hand, assert that the bottom has been knocked out of the dyewood market by the enlargement of the manufacture of synthetics in the United States and they have lost much of their previous interest. They admit, however, that there is a large business still to be done in the tanning industries, which are heavy consumers of dyewoods, but many have passed up the possibility of this business on the ground that returns are not sufficient for the investment required at present prices.

Meanwhile, continues *The World's Markets*, extract makers are finding that if they want to get any supplies of raw woods, they must import them directly for their own use and a number of them have taken steps accordingly, though much against their inclination to go into the import business. This is especially so as to logwood and fustic. These have been selling consistently for months at $60 to $80 per ton as against $15 to $20 in 1914. Others include Brazilwood, quercitron and quebracho.

Imports during the current year to date, as compiled by the U. S. Government, show that the logwood arrivals totalled some 48,863 tons and imports of other woods totalled 2,938 tons. These figures represent a considerable increase over the figures for the corresponding period in 1919, but by far the greater proportion of the imports this year has been made by extract manufacturers directly, as many importers have stopped bringing in these woods this year and some have done little since the war ceased. They assert that the previous policy of consumers has not been of a kind to work to the best interest of the importers and they decline to renew this class of trade. Nevertheless there is good business waiting for such importers as care to take hold, it is stated by the extract makers. And in view of the marked slump in ocean freight traffic, such an enterprise is most opportune.



The reason why Americans have suddenly turned to buying wooden shoes in Europe: Automobile washers wearing wooden shoes

Wooden Shoes and Automobiles: Why Sabots Are Imported

AT first thought there seems to be no relation between wooden shoes and automobiles. But one never can tell these days. Wooden shoes play an important part in auto building; indeed they probably reduce the cost of autos by six and three-tenths cents each—if figured out by an efficiency expert.

Automobile chassis have to be washed after they are built and before they are taken to the big room where the bodies are put in place; for after that all ablutions have to be administered very carefully. For this all-over bath soft soap is used—pails of it—and the water is applied with a hose.

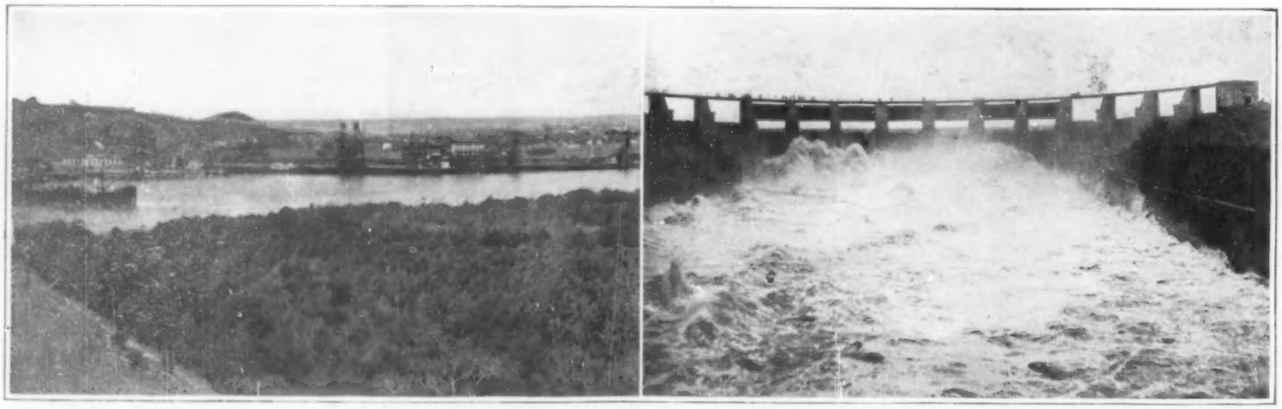
At first the auto companies provided high rubber boots for the men who did the work; but they soon found that soap and rubber did not agree, and that the bill for rubber boots was quite an item. And when the war came on, and the price of rubber soared, indeed, it became quite appalling.

So some bright young man got a lot of wooden sabots—brought from Holland or somewhere for actors—and tried them out. The workmen stuffed paper tightly in around their feet and encircled their legs with pieces of old slickers and found that the result was very satisfactory when worn with the usual apron. The shoes got soaked through in time, of course; but by keeping two pairs in use for each workman—one to wear and one to dry—no trouble was had.

But, during the war, nobody in either Holland or France or anywhere else in Europe could guess what the mischief Uncle Sam wanted with so many wooden shoes. Some people thought Mr. Hoover was saving leather for the Allies; others thought that we were trying to show our affection by contenting ourselves with what the Allies had to put up with; and still others insisted that the Reds wanted them to throw into machinery that was making munition. But nobody guessed that they were "to wash autos in."

Chemicals from Gas Residuals

THE Chemical Works Department of Glasgow Corporation, which was instituted about 18 months ago, as an adjunct of its gas department, for the purpose of manufacturing chemicals from the gas residuals, will, it is expected, help to reduce the cost of gas to consumers. It was the custom until about a year ago for the corporation to dispose of the residuals to private firms, from which it received a sum for the use of the buildings and equipment and a certain amount for the materials. When the chemical department was formed experiments were carried out which resulted so favorably that the municipality decided to terminate the contracts with the private firms and to undertake the work itself.



Left: Balboa at Pacific end, showing entrance to dry dock, coaling plant, oil tanks, shops and radio station. *Right:* The spillway and channel in center of Gatun Dam. View taken when it was discharging the overflow of Gatun Lake. Maximum capacity, 187,572 cubic feet of water per second, which occurs only during floods of the Chagres

Four-masted steel sailing vessel being towed through Culebra Cut by two tugs

Panama Canal Facts

How the Panama Canal Saves Time and Distance

THE Panama Canal extends in a general north and south direction from the Caribbean Sea to the Gulf of Panama, and it is located between the eighth and ninth parallels of north latitude. It runs through a strip of United States territory known as the Canal Zone which extends five miles on each side of the center line of the Canal. At the Atlantic entrance is Colon, a city of 30,000, and at the Pacific end is the city of Panama, with about 65,000.

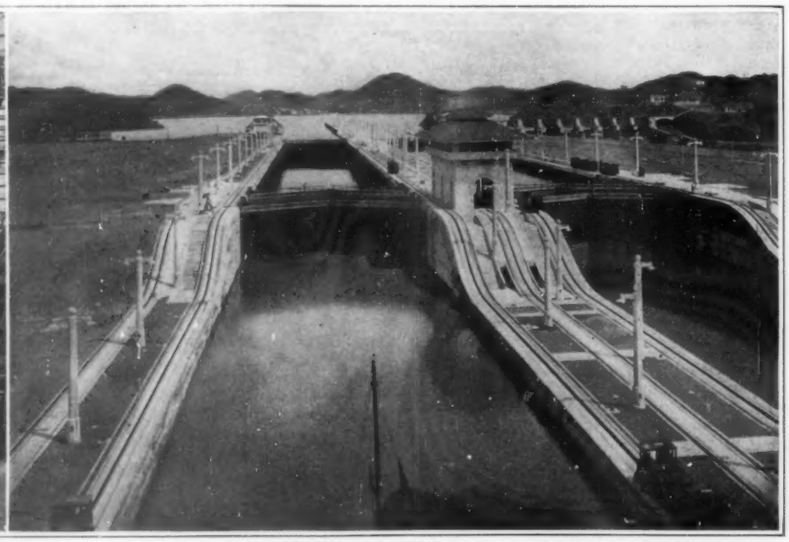
The French began work on the Canal January 20, 1882. The French rights were purchased by the United States Government on June 28, 1902. American occupation began May 4, 1904, and on August 15, 1914, the Canal was opened to commerce.

This great waterway is a lock canal. It was built by forming fresh-water lakes in valleys on either side of the Continental Divide and connecting these by the stretch of canal in the Culebra Cut through the Divide. Gatun Lake has a surface elevation of 85 feet above tide water. Descent is made to the ocean on each side by double locks in three steps.

The length of the Canal from deep water to deep water is 43.84 miles of which 12.76 miles are sea level section and 31.08 nautical miles consist of lakes and locks.

The width of the channel in sea level sections is 500 feet; in Gatun Lake, 500 to 1,000 feet; and the bottom width in the Culebra Cut varies from 300 feet to 600 feet. On account of the great slides, the maximum width across the Cut (at Culebra) between the outer edges of slides is about 3,000 feet. The number of locks is twelve, arranged in pairs; the number of lock gates is forty-six, and the total weight of the steel in all the gates totals 60,000 tons. The concrete used in all the locks totals 4,500,000 cubic yards.

The depth of water in the Atlantic section is 41 feet at mean tide; in the Pacific section, 45 feet at mean tide; and the depth of water in the Lake and Cut sections is from 45 to 85 feet, while the elevation of the bottom of the Canal in the Gatun Lake above sea level is 40 feet.



Left: Elevators piling up cargo inside Government pier sheds at Cristobal. *Right.* Miraflores Lock, looking toward Miraflores Lake. Note the Lake spillway to the right of the locks

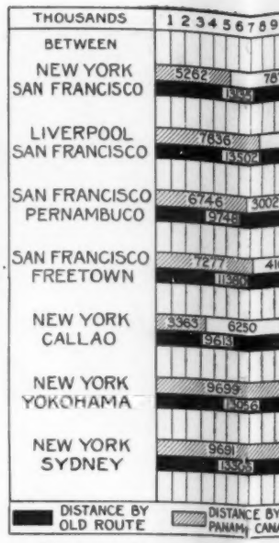
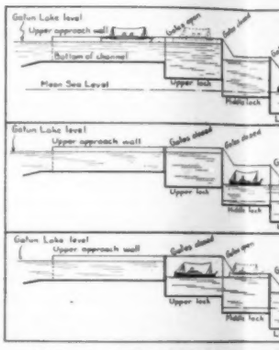
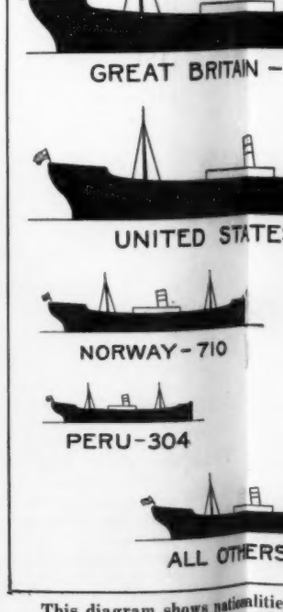


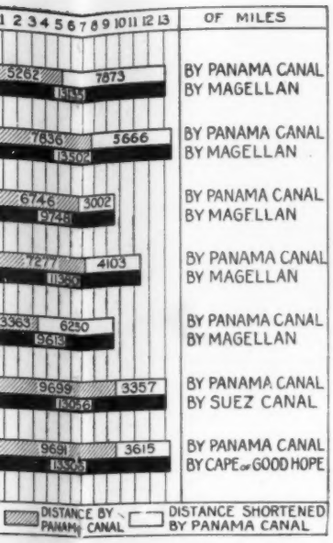
Diagram showing distance sav ship routes by making use o Thus, distance from New Yo is reduced by thr



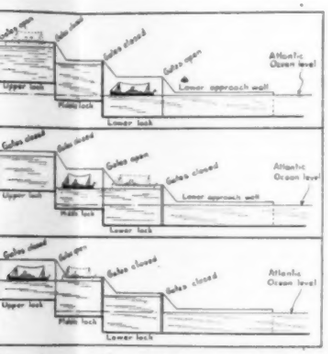
Diagrams showing the successiv in raising a ship from the At Gatun Lake level by means o the Gatun Lo



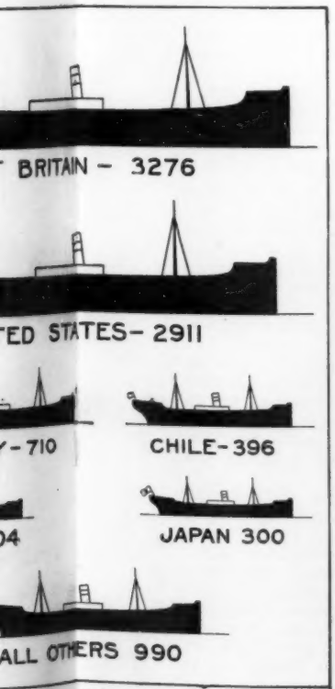
This diagram shows nationalitie bers of vessels which passed Canal from its opening t



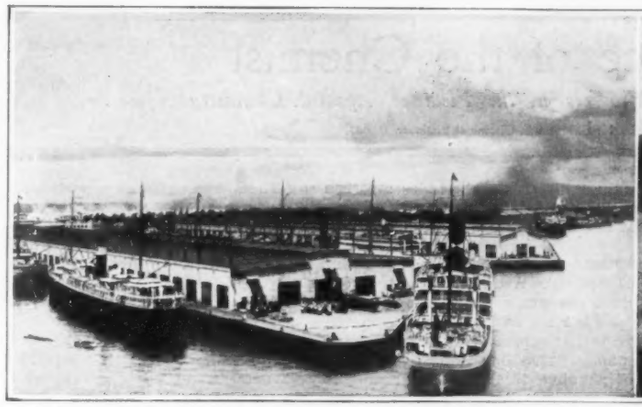
ing distance saved on various steam- making use of the Panama Canal. ce from New York to San Francisco s reduced by three-fifths



ing the successive operations involved hip from the Atlantic Ocean level to vel by means of the three flights in the Gatun Locks



hows nationalities and respective num- s which passed through the Panama om its opening to January, 1920



Left: **View of the new Government piers at Cristobal at the Atlantic entrance to the Canal. Canal also provides coal, fuel, oil and water storage for the supply of shipping.** *Right:* **A stretch of the Canal showing the cruiser "Renown" passing through the Canal with the Prince of Wales aboard. To the left is the Panama Railroad**

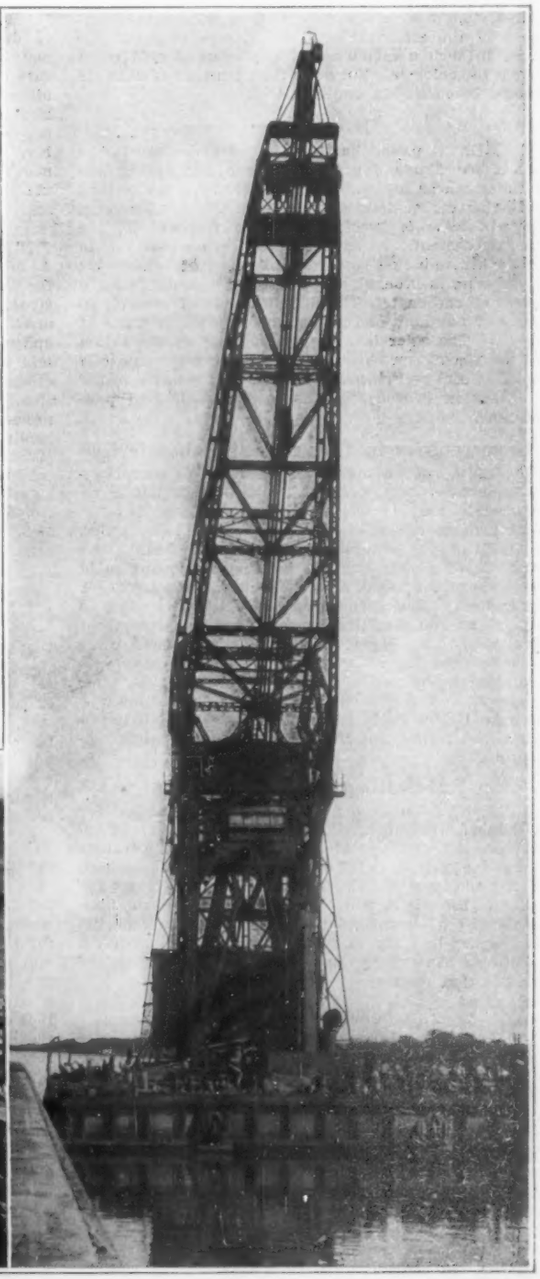
The total excavation done by the French that proved useful in the revised American canal was 27,708,000 cubic yards. The additional excavation necessitated in taking out the slides was 62,052,000 cubic yards; and the total excavation from the channel is about 252,133,000 cubic yards. In point of magnitude the greatest single work at the Canal is the Gatun Dam, which is 1½ miles in length, ½ mile thick at the bottom, and 100 feet at the top. The elevation of the crest is 105 feet above sea level, and in building the Dam, about 23 million cubic yards of material were put in place. In the center of the Dam is a spillway 808 feet long, capable of discharging 187,572 cubic feet of water per second. The total cost of the Canal to date is approximately 375 million dollars.

The number of commercial vessels which had used the Canal to January 1, 1920, was 8,887, carrying 33,668,313 tons of cargo, and there is a steady growth in the traffic. The accompanying diagram, showing the nationalities and the respective numbers of vessels which have passed through the Canal, reveals the influence of our war-built merchant fleet in giving our flag adequate representation. The bulk of the 2,911 United States vessels that have used the Canal must have passed through it in the post-war period.

The purpose of the United States in cutting through the Isthmus of Panama at a cost of nearly 400 million dollars was to shorten the ocean trade routes of the world, and particularly to bring our Atlantic and Pacific coasts closer together by avoiding the long voyage around Cape Horn. There was also the military advantage of enabling our warships to pass expeditiously from the Atlantic to the Pacific and vice versa, thereby obviating the necessity for maintaining two separate fleets.

The accompanying diagram shows how great a saving of time, distance and costs has been secured by the opening of the Canal. The voyage from New York to San Francisco has been shortened from 13,135 to 5,262 miles, a saving of 7,873 miles. A vessel sailing from New York to Callao steams only 3,363 miles as against 9,613 miles by the Straits of Magellan, a clear saving of 6,250 miles. Vessels bound from Liverpool to San Francisco save 5,666 miles.

Increasingly, as the traffic has grown, the Canal has become self-supporting, and in the fiscal year ending June 30, 1919, the revenues earned in excess of current expenses were 241,822 dollars. This estimate does not include any allowance for depreciation or any interest charges on the capital investment of 365,415,985 dollars.



Left: **This view shows ten United States Destroyers in the middle chambers at Gatun Locks when our Pacific fleet passed through the Canal.** *Right:* **Floating crane "Hercules," 250 tons capacity, at Gatun Locks. The Canal has two of these cranes**

The Service of the Chemist

A Department Devoted to Progress in the Field of Applied Chemistry

Conducted by H. E. HOWE, Chemical Engineer

Transporting Chemicals

IN the May number of the *Chemical Age* there is given under the heading, Transportation of Chemicals by Ship, the British Board of Trade provisions for sea shipment of chemicals. Specifications as to size of packages are quoted, followed by specific remarks concerning the shipment of 16 materials. Many of the restrictions would be expected by the average chemist, but a chemist is not always at hand when a cargo is being stored away. Sodium chlorate may be cited as an example: "The chlorate should be packed in iron drums, or if that is not possible in paper-lined casks of sufficient strength not to allow any of their contents to escape when subjected to rough usage. Casks or drums containing the chlorate should not be stored in the same hold with combustible materials, or should be separated from such substances by a partition. They should not be stowed in the neighborhood of the strong mineral acids, especially sulfuric acid, in such a manner that any escaped acid could reach the chlorate. Not more than ten tons of chlorate should be carried in one hold."

Dry Dyeing

A FRENCH patent has been issued and noted in the *Color Trade Journal* for June for dyeing materials such as cotton, silk and velvet by a dry method involving carbon tetrachloride, with which ammonium gallo-trioleate is precipitated as a mordant by the electric current. After mordanting in an iron vat, in which a wire basket is fitted with electrical connections, the dyeing is brought about in a bath containing 200 parts of carbon tetrachloride, 75 parts of alcohol, 20 parts of mordant, and 10 parts of dye for 30 parts of fabric. The color is fixed on the fiber by the action of the electric current, and after dyeing the fabric is dried in air, well rinsed in a 2 per cent solution of the mordant in benzene, and is finally washed in pure benzene.

Opportunities in Government Laboratories

THIS is not an appeal to scientists to accept appointment in Government laboratories, but a reminder to the industries that opportunities do exist for them in many of our Government laboratories. Several of the establishments could undertake researches of direct benefit to industry if support could be given through special coöperating arrangements, or by actually placing men on the fellowship plan to benefit by the direction afforded and the equipment available. This is particularly true at present when some of the laboratories find themselves unable to maintain an adequate staff with the funds at their disposal. Not only is opportunity afforded in this way to extend the boundaries of our knowledge, but to improve the training of the men so placed by their employers.

Lubricating Abrasive Wheels

A PATENT has been granted covering a method for lubricating abrasive wheels. This consists in immersing the wheel, previously heated to a temperature above the melting point of the filler, in a molten bath of the chosen material. The filler thus penetrates the pores of the wheel, which upon removal from the bath is rotated while the filler is still molten so that the excess may be flung off. One of the satisfactory fillers mentioned in the patent comprises a mixture of paraffin and rosin.

Japanese White Leather

THIS leather is made by first soaking dry hides in a river when the water is not too warm, or for a longer period earlier in the year, until the hair will slip. The hides are then washed and shaved and tramped with salt, after which they are packed in a cask and left from one to three days. They are now ready to be bleached in the sun, but on dark days the hides are trodden to prevent mottling of the grain. As soon as crystals begin to appear on the grain side of the leather this part of the process is considered finished. It is a difficult problem to decide when this stage has been reached. The salt is now removed by soaking, but a small quantity, determined by tasting, is allowed to remain. The hides are next dried, then sprinkled with water, and oiled on the flesh side with rape seed oil. By tramping again for half a day the oil goes through to the grain side. The hides are then exposed to the sun again, treaded the second time, washed with water, again treaded, and again bleached in the sun.

The color should now be white, even the yellow tint of the oil being bleached out. After storing for one or two months the hides are again bleached for a few hours, more of the salt is removed by soaking, followed by another exposure to the sun, another soaking until just wet through, another treading, followed by staking. This round of sunning, treading and staking is repeated until finally they are damped over night and stretched for a final drying in the sun.

The product after this six months' process is soft, tough, and white.

Keeping the Factories Running

THOSE who are still wondering whether the dye industry is entitled to adequate protective legislation may be interested to know that there are 67,585 separate establishments in the textile, paper, leather, and allied industries which are dependent to a greater or less degree upon supplies of dyestuffs. Over 2,000,000 people are employed in these factories, there is an investment of four billion dollars, and they produce about 25 per cent of our country's total output of manufactured products.

Spark Plugs

IN report No. 53 of the National Advisory Committee for Aeronautics, A. V. Bleininger discusses the preparation and composition of ceramic bodies for spark plug insulators. The porcelain of spark plugs must resist high temperatures, mechanical stresses, and sudden great changes in temperature. The porcelain must remain a good electric insulator, must be strong and tough and have a constant thermal expansion. The composition of one of the best types expressed in per cents is Georgia kaolin, 10; Florida kaolin, 10; North Carolina kaolin, 10; Delaware kaolin, 10; calcine, No. 19, 40; and calcine No. 14, 20. These calcines are made up as follows: For No. 19, kaolin, 70.2; alumina, 27.8; and boric acid, 2.0. For calcine No. 14, kaolin, 56; precipitated magnesium carbonate, 18.2; and potter's flint, 25.8. A number of formulæ are given in the report.

Chemistry and Fire Protection

COPIES of a report submitted at the National Fire Protection Association meeting governing regulations for the storage, handling and use of such materials as celluloid, pyralin and similar nitro-cellulose compounds may be had from the secretary-treasurer of the association, 87 Milk Street, Boston. The products covered include many plastic substances having soluble cotton or other nitro-cellulose compound as a base, and the rules are applicable whether the material be in solid form like sheets, tubes or fabricated shapes, or be prepared as a lacquer enamel, thinner or cement.

Training the Consumer

THE War Service Committee of the Women's City Club of Boston is continuing one of its active projects, namely, a clothing information bureau which seeks to become a center of information and service for those who desire help on the problems of textiles and clothing. This is another step toward making it possible for anyone to know the truth concerning what they buy, and the program outlined is one which if it can be followed should soon make it necessary for the merchant to rely more fully upon the laboratory than most of them have heretofore been willing to do.

Among the points upon which the consumer should be trained are knowledge of the cloth, manufacture, dyeing and finishing of textiles; methods of testing the value of cloths before purchasing them; knowledge of the properties and values of the four leading textiles, and the necessity of learning where reliable materials are made, so products of such factories may be demanded. A point is made that the trained consumer should be in a position to require honest information from the sales force and from advertisements, and that a merchant prepared to give this information, much of which is only obtainable through the laboratory, shall be rewarded by sustained support of his establishment.

The Bureau affords opportunities to test cloth before purchasing it.

In Canada one of the great department stores has established a research bureau which works in the interests of the ultimate consumer just as much as of the establishment. It seeks to prevent misrepresentation in the weight, measure, substance or purpose of any form of merchandise. The laboratory serves in many lines of chemical analysis and tests, because of the diversity of materials offered by the establishment. It acts in an advisory capacity to the department buyer and sees to it that even the advertisements correctly describe the merchandise that is offered. Wool is made to mean all wool; linen, flax fiber; silk, natural silk; and if its source is otherwise, some name such as fiber silk must be used. Unlike most establishments, this one indicates furs by their actual names as well as the trade name under which they are more frequently sold.

Titanium in Enamels

IN a recent number of the *Journal of the American Ceramic Society*, Landrum and Frost describe a series of experiments with titanium enamels. Some of the conclusions drawn indicate that the most promising factor of the possible use of routile is shown in the unusual durability of such enamels under all tests. The chemical resistance is much greater than is the case of ordinary enamels and the high gloss produced gives a surface resistance to abrasion and the consequent speedy failure of the enamel after the surface is once broken is largely avoided. Such enamels also have a higher heat resistance. There is difficulty, however, in maintaining a satisfactory state of suspension of the titanium oxide in the frit. It seems that titanium oxide has no place in the ground coat, and while there are several technicalities to be overcome the final conclusion is that the good qualities more than offset the bad ones and that it should be possible to develop enamels containing titanium which would have very marked practical value.

Cast Iron in the Light of Recent Research

THIS is the title of a book by William Herbert Hatfield, a second edition of which has recently been reviewed in the *American Technical Press*. It is a fairly complete compilation of numerous discoveries made through research during the last half century. Beginning with the work of Turner on the influence of silicon in cast iron, the book brings together practically all the important papers scattered throughout the journals from 1885 to 1918. The book although written from the viewpoint of English metallurgy is one that will be appreciated by the American metallurgist and those concerned with improved foundry practice.

Utilizing Scrap Leather

SOME scrap leather finds its way into the fertilizer industry, and recently a British patent was granted for the production of a substitute for ordinary leather from scrap. The patent describes the process as one which first reduces the scrap leather to a powder, after which it is cleaned with oxalic acid and then mixed with an adhesive made of liquid glue, boiled linseed oil, carbolized oil and oil of cloves. This mixture is formed into sheets.

Another patent gives as a formula for a leather composition 16 pounds of rubber, 20 pounds of leather reduced to flour-like subdivisions, 5 pounds of calcine magnesia, 3 pounds of sulfur, 3 pounds of brown factis. If a hard vulcanite is to be made 32 pounds of rubber, 60 pounds of leather flour, 16 pounds of sulfur, and half a pound of magnesia are used.

In this process, waste or reclaimed rubber is reduced between rolls and then an intimate mixture of leather flour, etc., is added, followed by the small amount of factis or other fatty material, after which the whole is comminuted. The temperature of the rolls is then brought to a point to cause partial vulcanization, after which it is put through calender rolls and reduced to sheets while the final temperature is raised to 240° F. The sheets, a sixteenth or twentieth of an inch in thickness, are superimposed alternately at right angles to produce greater strength.

The composition described is also used for coating canvas, for upholstery, etc., and in sheet form finds use as boot soles.

The Car That Goes Anywhere

IF you are the proud possessor of the kind of automobile that sells for $440 without a starter and $510 with, you are doubtless well acquainted with the way to justify such ownership in the eyes of your friends who sport eight-thousand-dollar limousines and chummy racers. The principal argument in this eternal debate over the never-disposed-of question "Why is a flivver?" usually simmers down to the claim that said flivver will "go anywhere." We produce herewith two photographs that may well qualify as exhibits for the defense in this case of Sporty Six, Expensive Eight and Tremendous Twelve vs. Tin Lizzie.

The motor sled is nothing especially new, but we do not recall having seen one that has been converted from an ordinary automobile with quite so little change as the one shown in our first view. For the front axle assembly with its wheels has been substituted a runner outfit, suspended from the springs, which it will be observed have been turned upside-down and shifted from their usual lateral position to a longitudinal one in preparation for this change. At the rear end there has been no necessity for such modification. The photograph shows distinctly a valve-cap protruding through the rim, which may be taken as confirmation of the impression which one gets that the tires have not even been removed. Traction in the snow has been secured by the attachment of an outer sheet-metal tread with wooden cross pieces—aside from this a rear view of the machine would present the customary appearance of a stripped chassis of this car. Doubtless when conditions in Nome, Alaska (the residence of the owner) approximate those of summer driving, he goes back to the summer style of vehicle, and is grateful that he has been able to follow the manufacturer's instructions with regard to the removal of the rear wheels—"Don't remove them."

The other ingenious modification of the car that goes everywhere is for the purpose of making it go where many owners would hesitate to send it—into the water. The forward part of the car, containing carburetor, ignition system, and everything else that would effect the running of the engine if submerged, is housed in the body of a big flat-bottomed craft, and the rear axle is suspended over the stern of this craft, just nicely out of the water. This owner has found it necessary to remove the tires, for obvious reasons; then he has fastened six broad wooden blades to each wheel, bolting them between plates that in turn are secured to holes in the rim so that they stand up from the rim to the necessary height. The result is an admirable gasoline launch, which is steered from the wheel of the chassis in quite the usual marine fashion, and which gives its owner, again an Alaskan, a big lift toward capturing his share of the salmon run.

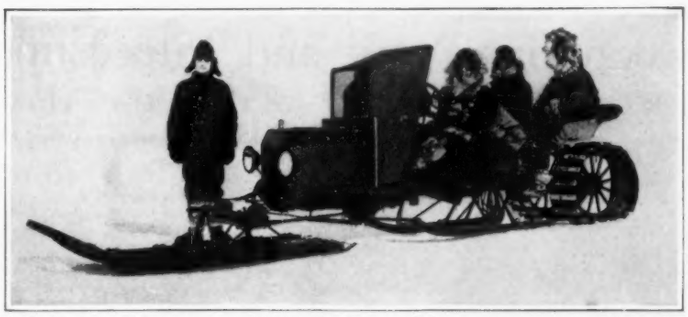
Sweet Potatoes as Stock Food

SWEET potato silage is a comparatively new contribution to an already variable ration for live stock in the South, a series of experiments covering a period of years as conducted by the agricultural experiment station of the University of Florida determining its fitness as a stock food. As a major crop in the Southern States, equalling in value that of the upland cotton acreage in Florida, its use in sustaining cattle during the winter months enhances its appreciation as a farm product.

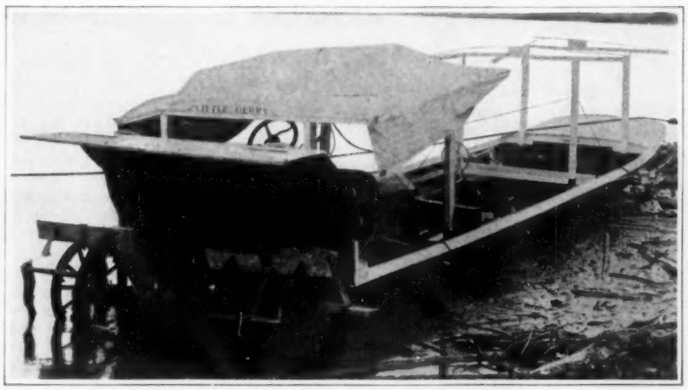
Sweet potatoes, diverted from the storage house to the silo, are run through the ensilage cutter in the same fashion as corn or other products converted into silage. The storage facilities as now in vogue involve a loss of thousands of dollars in sweet potatoes in the South; whereas, among the virtues claimed for the conversion of the tubers into silage are the absence of loss from storage, reduction of required space for preservation, and no waste in feeding.

Chemical analyses of sweet potato silage and corn silage fail to disclose any appreciable difference. The former has a moisture content of 54.87 per cent, crude protein 1.82, nitrogen-free extract 39.41, fiber 1.48, fat 0.66, and ash 1.85 per cent. Silage manufactured from matured corn analyzes as follows: Moisture 73.7 per cent, crude protein 2.1, nitrogen-free extract 15.4, fiber 6.3, fat 0.8, and ash 1.7 per cent. Feeding experiments in Florida have justified the claims that 100 pounds of sweet potato silage will replace from 150 to 200 pounds of corn silage in the ration. The uneven ratio favoring the feeding value of the potato product is attributed to a minimum water content, and the presence of two and one-half times as much nitrogen-free extract as the corn silage.

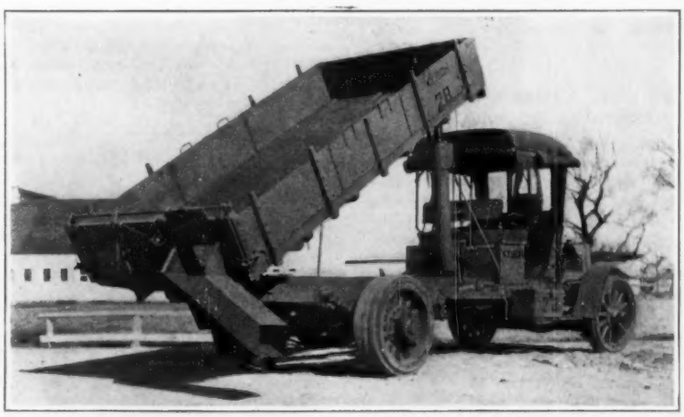
Comparative tests to ascertain the relative feeding values of sweet potato silage and sorghum silage in the production of milk yielded the following results: The cows subsisting on sweet potato silage, wheat bran, and cottonseed meal produced 2,641 pounds or 307.1 gallons of milk. For a corresponding period of time, cows fed sorghum silage, wheat bran and cottonseed meal yielded 2,415.8 pounds or 280.9 gallons of milk.



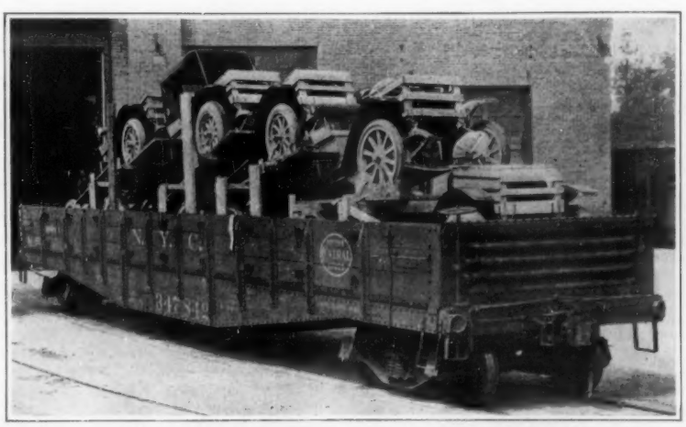
The flivver of the snows, as improvised from the temperate-zone model, with an absolute minimum of dismantling and no real structural modification



Another extension of Lizzie's vogue, which adapts her for the propulsion of light boats



A recently introduced dump truck of novel design, in which is produced an adjustable chute that makes it possible to deliver stone at the side of the road



This novel method of loading makes it possible to ship five trucks on every flat car, in place of the two which has always been considered the limit

The Truck that Dumps at Any Angle

THE New York State Highway Commission has lately designed and placed in operation a uniform type of truck body for use in construction and maintenance work on the highways of the State.

The truck body is 12 feet in length and 6 feet in width. The body is mounted with a hydraulic hoist so that it may be used as an end or side dump body. The side sections may be removed entirely leaving a platform for hauling asphalt or other materials of that sort in barrels. The side sections may also be removed singly so that rock or sand may be dumped to the side in various sized piles as required.

An adjustable chute inserted into an opening provided in either side of the end gate makes it possible to deliver stone at the side of the road instead of only in the middle. A sliding door operated by a hand lever situated below the center of the end gate provides the opening necessary for the admission of the chute. The load of rock may be dumped in the middle of the road after removing the chute.

Shipping More Motor Trucks to Each Flat Car

LACK of transportation facilities of late years has called for no end of ingenious improvisations. Shippers have had to alter their packing methods in order to take advantage of all transportation facilities, both usual and unusual. A case in point is shown in the accompanying illustration, which shows how one motor truck manufacturer has been shipping his vehicles in flat cars in such a way as to get five trucks in where formerly only two were carried. As will be noted, the first truck is placed at the forward end of the flat car, with all four wheels resting on the floor. The next motor truck's front wheels rest on the platform built over the first truck, while the rear wheels rest on the floor. The third, fourth and fifth trucks are arranged the same way, with their front wheels held high by means of props, while their rear wheels rest on the floor of the car. In this manner five trucks are accommodated in the flat car, the only restriction being the height of the load which must take into consideration the clearance of the railroad right-of-way.

Inventions New and Interesting

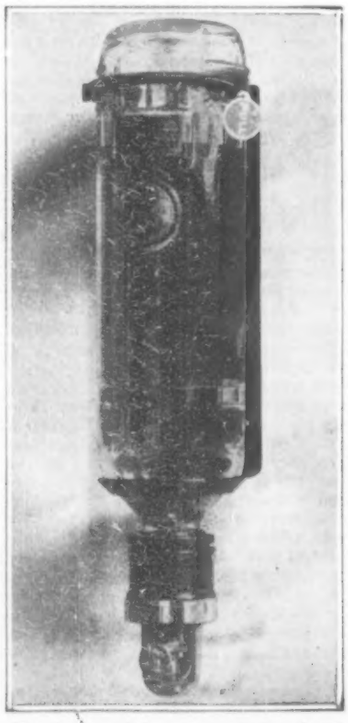
A Department Devoted to Pioneer Work in the Arts

Working the handle back and forth advances the plow bit by bit

A One-Man Plow for the Horseless Farmer

AN ingenious German has invented a one-man plow which has been tested at various agricultural exhibitions with conspicuous success. This plow, which is shown in the accompanying illustration, is operated by working a handle back and forth. A novel arrangement of levers causes the plow to advance bit by bit as the handle is worked. Needless to say here, the process must be a slow one and no doubt calls for considerable muscular effort, as compared with the horse-drawn plow. But then they do not mind hard work in Germany, and time is not the quintessence of farming, especially in small-scale operations.

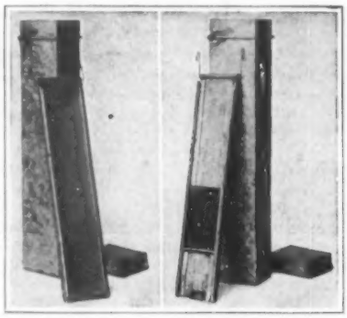
A similar idea is in the form of a man-drawn plow, which is being developed in France for small farmers.



The fusing of the automatic fuse head at the bottom of this extinguisher releases the contents

Something New in Tank Development

A NEW developing tank for photographic films and plates has recently been invented by a Canadian, Chas. G. Brambrick, of Brooks, Alberta. The tank is made of sheet metal and is long and narrow, as it has been found that the chemical solution for developing plates and films keeps much longer in a tank so designed. The tank contains a number of holders which are designed to accommodate either roll films, cut films or glass plates. The holders have an adjustable edge which holds the negatives securely to the holder. The tank forms a most convenient and economical means of developing either films or plates or both in quantities.



A tank for developing films and a similar tank set up for holding plates

A Fire Extinguisher That Operates Automatically

GREAT strides have been made in recent years in the application of chemicals to the fighting of fire, making it possible to extinguish the more modern dangers, namely, the fires of electrical origin. Then, too, the overhead water-piping systems with automatic sprinkler heads, while expensive, have marked a great advance.

But with the advent of the automobile, with its highly explosive fuel and its electrical equipment offering endless opportunity for short circuits and consequent fire, a new problem developed. The worst feature of an automobile fire lies in the fact that the blaze attains headway so quickly that staying to operate the pump-type hand extinguisher usually recommended for that purpose, is exposing the operator to great danger. The safest course is to keep away. The car should not be protected at the expense of life.

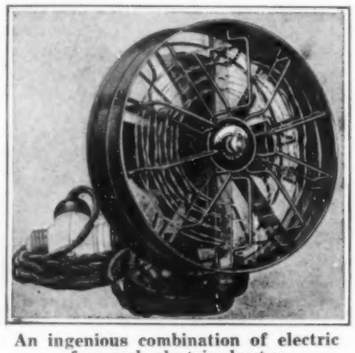
It has remained for Harrison H. Boyce, an inventor of Brooklyn, N. Y., to develop an extinguisher which is automatically operated in the face of fire. Briefly, it is an aquamarine glass container holding a fire-destroying chemical sealed under pressure, which is sprayed out in a wide circle of vapor upon the melting of an automatic fuse by the fire itself. The vapor in contact with the heated air changes to a dense blanket of gas which instantly smothers the fire down to the tiniest spark, according to the claims of the inventor. The fusible member is simple and positive in operation.

When the fire extinguisher is to be used by hand, the operator simply holds it with the metal end up, unscrews the fuse end, and dashes the contents at the fire. The chemical, retaining some of the pressure, is slightly effervescent and rushes out of the container with considerable velocity. The action of the chemical on the fire is the same as in automatic operation.

Needless to say, the new extinguisher need not be limited to use under the hood of an automobile. It can be used in the home, shop, store, shipping room, and elsewhere. By means of a bracket four automatic extinguishers can be mounted overhead in factories.

To Lock Your Car, Take Off the Wheel

SOMETHING a little bit different in the way of a convenient and thief-proof steering wheel is shown in the accompanying illustration. In the first place, this wheel might well be called the fat man's friend. It does not merely tilt up a little way—it tilts clear over to the front of the steering column, so that anybody who can sit in the driver's seat can get out of it with as little trouble as it costs him to stay in it. In the second place, this full tilting feature is supplemented by a very simple means of detaching the wheel completely. The manufacturer very sensibly suggests that if you take off your wheel and take it with you when you leave your car no thief is going to molest it. A steering-wheel lock that can be broken is of no effect after breaking has been effected; but a car without a steering wheel, while it is conceivable that the thief might find some way of moving it, would cry "Stop Thief" to high heaven and certainly cause the arrest of its occupant before he had got very far with it.

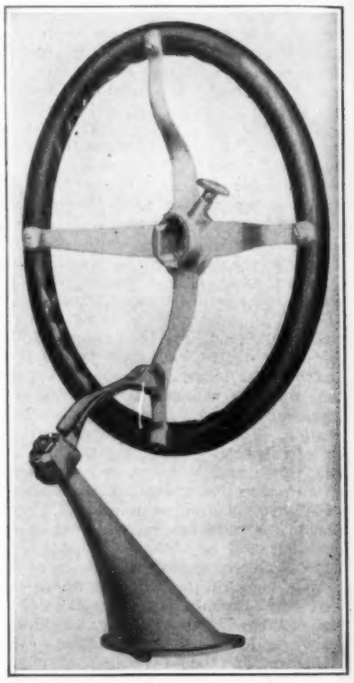


An ingenious combination of electric fan and electric heater

An Electric Fan That Heats, Cools and Dries

AN electric fan of the type shown in the accompanying illustration will heat a room and also keep it cool. It is an electric fan fitted with a combination powerful heater having a nichrome element. Thus the fan may be used to blow a current of heated air. It is claimed for this fan that by actual tests it will raise the temperature of a room quickly and at relatively economical cost.

The heating element of this novel fan consists of special resistance wire wound in spiral form on strips of mica, arranged radially as shown. The guard, instead of being made entirely of wire members, has a cylindrical shield, as shown, for the purpose of concentrating the heat so that it can be distributed by means of the current of air created by the fan.



Steering wheel that tilts all the way over and is detachable too

A Jardiniere That Waters Itself

FROM France comes the self-watering jardiniere invented by M. Pinson of Paris. This novel device consists of a jardiniere with double walls. The space between these double walls is used as a reservoir for holding a certain amount of water, and dipping into this water are a number of tubes bent in the form of siphons and arranged symmetrically, each containing a wick. Capillary attraction causes the water to be drawn up the tubes and around the bend of the tube, after which the water drops down on the earth contained in the flower pot placed in the jardiniere. If the water is found to flow too freely, the wicks can be trimmed so as to curtail the flow. Depending on the capacity of the jardiniere, sufficient water can be placed in the retaining space for as much as two months without attention.

Wicks and siphons cause this jardiniere to water the plant without attention

Paper From Alaska

(*Continued from page 64*)

problems and several methods of logging would likely be used on the same general operation.

In 1918 $8.95 was the average cost for raw pulpwood at the mills in California, Oregon and Washington. It is believed that pulpwood can be produced much cheaper in Alaska, as the bulk of the wood will be cut within less than a mile of the water's edge. Figures of $4 to $6 per cord would normally approximate average conditions even under present primitive methods of logging.

Construction from the ground up summarizes the requirements to be met in Alaska, which is still a comparatively raw and undeveloped country. Following the acquisition of the timber and source of power, the mill site and town could then be advantageously located. The site would need to be cleared before construction could begin. A sawmill would no doubt be required and the first logging would be for the clearing of a mill and town site, and the building of necessary structures, such as wharves, storehouses, mills, dwelling houses, offices, machine shops and stores.

The mainland and islands of southeastern Alaska are generally mountainous, and there is little level land either as upland area or along the shores. Along much of the coast line the hills and mountains rise abruptly and the dense forest growth, extending down to the level of high tide, overhangs the steep banks. The islands are separated by an intricate system of waterways and fiords, known locally as straits, canals, channels, passages, sounds, narrows, inlets, bays, coves and arms, some of which reach far inland. Many of these waterways are very deep and can be safely navigated by the largest ocean steamers, but some are so shallow as to be navigable only at high tide by boats of moderate draft. The coast and entrances to harbors are rocky and in places the greatest care is necessary in order to avoid rocks that are barely submerged. The topography is so rough that only in favored localities or at great expense can wagon or tram roads be constructed. The waterways are, therefore, of great value in affording routes of communication between this region and the Pacific Coast ports of the United States. Indeed, were it not for water transportation the mining and quarrying industries in southeastern Alaska could scarcely have been developed. Fortunately the timber which would be used is situated along the coast and on the large islands of southeastern Alaska and as previously stated, on the Tongass National Forest.

Every Automobile Its Own Elevator

(*Continued from page 65*)

ing stories, it is generally necessary to alternate their positions from floor to floor in order to give the ascending and descending cars ample space in which to maneuver in leaving one ramp and in approaching another. This arrangement takes up a good deal of valuable space and, besides, is apt to impose architectural difficulties and to call for a disposition of piping for heating, drainage, water supply, etc., which is much more complex than where the leads are alike on every floor.

Nevertheless, the ramp is desirable, for it promotes rapid travel up and down through the building and the freest movement to and from the street. Further than that, where numerous cars or trucks are concerned, congestion of traffic in front of the structure is reduced to a minimum. But the present and the steadily rising price of real estate, especially in populous and busy centers, makes it imperative that the warehouseman, the manufacturer, the storekeeper, and the garage operator, shall get the fullest returns for every square foot of floor space, and thus reduce the overhead charges as far as possible. And now we come to a type of ramp that constitutes a novel and a very valuable development in the art: one that has all of the virtues of the usual ramp with worth while characteristics peculiar to itself. It is the invention of Fernand E. d'Humy, an experienced American engineer, who was inspired primarily to better the housing facilities offered by the run of city garages. His problem was to evolve a modified form of ramp and a type of structure to go with it which would abridge the interfloor rise and, therefore, the length of the ramp. His scheme, as now evolved, permits the use of his motor ramps in tall buildings of many stories.

Broadly, the fundamental plan calls for a structure divided longitudinally or transversely into two sections by a central wall, with the floors of the neighboring divisions staggered or half a story apart. Manifestly, a motor vehicle, passing through the dividing wall, on the ramp, would have only half a story to climb or to descend in going from one floor to the other. Therefore, the ramps themselves need not be more than 40 feet long with a maximum gradient not exceeding 15 per cent. Horizontal space is economized by giving the ramps a curve, which incidentally makes it easier to control a descending car and to swing it into the next ramp unit. Accordingly, one complete turn on the ramp suffices to carry the vehicle a whole story upward or downward on either side of the dividing wall.

Compared with a number of recent garages equipped with the ordinary ramp construction, the d'Humy motor ramp makes it possible to house on the same floor area from seven to twenty additional cars. But this does not cover all of the material advantages. The d'Humy motor ramp can be placed in the center of a building, where it will in no wise interfere with natural lighting, and therefore leaves the best illuminated sections for the storage and the overhauling of the machines. Next, a matter of vital concern, the cars or trucks can move in or out freely in a continuous stream, either to meet the rush-hour service period or to take care of them when they are homeward bound in large numbers. Where conditions justify it, duplex concentric ramps or separate twin ramps would be provided to take care of the vehicular tide—one line for the up-bound and the other for the down-bound traffic.

It will be observed that there are no moving features, and neither electric current nor operators are required to make the ramps themselves available. It is estimated that the working charges for the elevators of a 5-story garage, capable of housing 400 cars, would total quite $4,380 yearly; and none of the trucks or cars could be got out of the building or stored if the power supply failed. Picture the risks run if fire threatened from a near-by building aflame! With the d'Humy structure, on the other hand, however high, all of the cars ready to be driven could be removed in short order, and it is quite likely that those with empty fuel tanks could coast down and get out of harm's way.

What applies to the garage is equally true of the factory, the warehouse, the great department store, etc. No matter on what floor are located the goods to be shipped or on what level incoming materials are to be delivered, the motor ramp enables the automotive truck or car to get there with dispatch and under its own power. In many manufacturing establishments of magnitude, raw materials as well as finished and partly finished products are moved about on the several floors by electrically-driven industrial tractors hauling strings of trailers. But when a train of these helpful carriers has to go up or down to other floors it is necessary to break up the train and

(*Continued on page 79*)

Consistent performance day in and day out, in storm and in calm, is a requirement which good ship power must meet

Type of gear so successful on this ship—cover removed
Manufactured by
General Electric Company
General Office—Schenectady, N. Y.

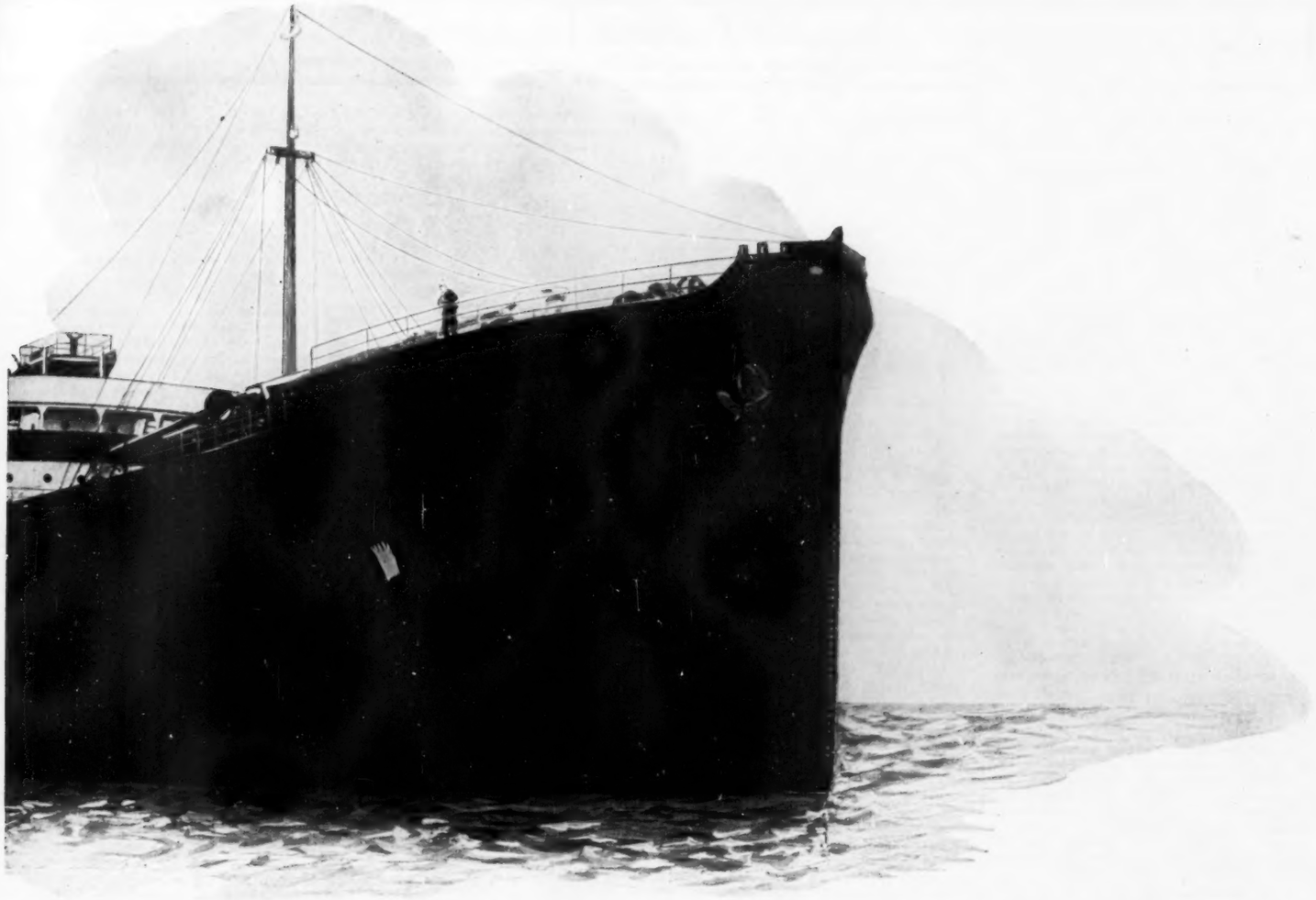
G-E Marine Geared Turbine Record in U. S. Merchant Marine

Units in service . .	288
H. P. Capacity . . .	829,100
D. W. Tonnage . . .	2,588,529
Miles traveled . . .	16,780,000

This nation had 144 Marine Geared Turbine vessels in service during the war—G-E equipment on 95 gave 81 per cent of the total service

Visit the G-E Exhibit at the Second Annual National Marine Show, Grand Central Palace, New York City, Jan. 24-29

GENERAL



Niels Nielsen on her trial trip

The Atlantic tested this Propulsion Set

FOR more than three years, the Niels Nielsen has plied steadily between the eastern United States seaboard and ports of France and Spain. She is 409 feet long and has been averaging 12050-ton loads of general cargo.

In her engine room today, showing only moderate wear, is a

G-E Curtis Turbine with Double Reduction Two-Plane Type Gears

which have propelled the boat 140,655 miles (August 1, 1920) since the very day she went into service.

The performance of propulsion machinery like this and of the duplicates driving those other long-service pre-war ships the Pacific, Eurana, Sucrosa and Hanna Nielsen, has won the confidence of skeptical, conservative men of the sea for the 1920 type of G-E Two-Plane Type Marine Geared turbines. This type embodies all the strength of its predecessor plus lowered tooth pressure, better tooth design, greater weight, less length and a more perfect uniformity of load distribution due to slip type pin couplings.

E L E C T R I C

Recently Patented Inventions

Brief Descriptions of Recently Patented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.

Pertaining to Aeronautics

COVERING.—T. J. CAHILL, 238 N. 12th St., Philadelphia, Pa. The invention relates to a wing covering more particularly adapted for airplanes which will render a tearing of such covering extremely difficult and prevent it from spreading. The covering includes a woven material and rows of stitching in said material extending at an angle to the weave of the same. The covering material could also be used as an envelop for the ballonnets of a dirigible.

Pertaining to Apparel

MATERNITY SKIRT.—C. M. GOLDBERG, 388 St. Nicholas Ave., New York, N. Y. This invention has for its object to provide a maternity skirt with a box plait having an outer portion to which a belt is secured, the inner portions of the box plait being continuous with the body of the skirt so that the plait may be increased or decreased, and the fullness of the body of the skirt correspondingly decreased or increased to fit the skirt of the wearer.

APRON.—W. P. SHARP, 161 Jefferson Ave., Columbus, Ohio. This invention has for its object the provision of an apron, or, in fact, any body garment provided with a waistband adapted to encircle the waistline, to be combined with means for retaining such garment in applied position without the aid of any of the conventional fastening means, such as tapes, buttons, or snap fasteners, and without loss of any time, the garment including a waistband and a resilient strip incorporated in the band

Electrical Devices

SEPARATOR FOR STORAGE BATTERIES.—H. T. ROBERG, Castana, Iowa. An object of the invention is to provide a separator which is of rubber composition and which will be a perfect insulator, which will outlast ordinary separators and at the same time be comparatively cheap to manufacture. A further object in using this material is to permit a battery to discharge at an unusual high rate and to cause a battery to quickly take the charge when in discharged condition.

TROLLEY POLE.—J. J. REGGIO, 2028 Dumain St., New Orleans, La. The invention relates more particularly to a construction whereby the trolley wheel when it leaves the trolley wire will be automatically lowered to a point below the wire and the wire suspension system so as to prevent injury to the latter trolley wheel or pole. The invention is so designed as to be readily applied to trolley poles already in use, simply by cutting out an intermediate part and inserting the new construction.

Of Interest to Farmers

PLOW.—E. B. KARN, Parma, Idaho. This invention relates to plows adapted to be drawn behind a tractor and especially designed for use on irrigated land, or where it is desirable to throw all the furrows the same way, wherein a plurality of gangs of plows is provided, oppositely arranged and adapted to be brought into operative position in alternation, and connected in such manner that they may be elevated out of contact with the ground and reversed to bring either gang into operative position.

MOWING MACHINE.—J. S. WHEELER, c/o Mesa Garage, Mesa, Ariz. The invention has for its object to provide a mowing machine of the multiple sickle type and a form of connection between the sickle blade and the mowing mechanism thereof; the machine is especially adapted for use with sickle mowers of the tractor type. When the machine is in motion it is so arranged that there will be two cutting strokes of the sickle for each movement of the pitman in each direction.

Of General Interest

SHAVING KIT.—R. H. BALL, Danville, Va. Some of the principal objects accomplished by the invention are to provide a simple, compact and sanitary kit for a shaving outfit in which provision is made for separating, ventilating and drying the lathering articles forming part of the outfit, and for receiving and separating the razor sections in order to prevent rattling by the contact of the parts with one another.

STRAINER.—L. TAUB, c/o Mac Taub Specialty Co., Suite 406, 51-53 Leonard St., New York, N. Y. The invention relates to strainers for cooking utensils, particularly tea-pots, coffee-pots and similar utensils. The prime object is to provide a means in which the strainer is adjustable with respect to the pouring spout of the utensil regardless of its position on the body thereof.

FLOWER OR PLANT HOLDER.—G. W. SCHIMMEL, Newtonpein, 49a, The Hague, Netherlands. An object of the invention is to provide a flower holder which can be forced into a bed of earth or other granular material and

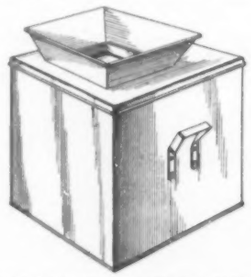
VIEW ILLUSTRATING AN ORNAMENTAL BED AND THE HOLDER

which will hold the flower or plant in upright position. A further object is to provide a holder which permits the flowers to be positioned in the bed without the necessity of first preparing holes to receive the same.

SNOW PLOW.—S. W. GASS, Tenino, Wash. An object of this invention is to provide a snow plow which can be conveniently employed in clearing sidewalks, streets, and the like, and which may be either pushed or pulled. A further object is to provide a snow plow which will embody all necessary strength and durability and which can be manufactured at a reasonably low price.

DISH.—P. R. SIMMONS, P. O. Box 103, Huntington, Ind. The object of the invention is to provide a dish for serving ice-cream, comprising a permanent holder and a replaceable container fitted in the holder. A further object is to provide a simple and inexpensive dish of suitable material for this purpose which can be securely held against displacement when the dish is in use, but easily removed or replaced at will.

SANITARY CONTAINER.—M. MISLIKOWSKY, 11 Jefferson St., Yonkers, N. Y. The object of the invention is to produce a garbage receptacle particularly adapted for use in butchers' shops, wherein the material to be



A GENERAL VIEW OF THE CONTAINER

thrown away may be tossed into the mouth of the receptacle and will be automatically conveyed to the receptacle body, whereupon the closure provided will automatically close and form an airtight seal between the interior and exterior of the receptacle.

Hardware and Tools

DRILL GAGE.—L. B. WEBSTER, 3813 Euclid Ave., Cleveland, Ohio. The invention has for its object to provide a flexible transparent gage which can be positioned around a twist drill and the like and which contains a scale consisting of lines at different angles relative to one edge of the device, and which scale registers with line of the lip clearance of the drill to indicate the angle of the said line.

AUTOMATIC PLUMB-BOB.—E. S. BUSH, 5133a Minerva Ave., St. Louis, Mo. The object of this invention is to provide a bob wherein the supporting cord is connected to the weight in such manner that when not in use the cord may be automatically wound up within the bob, and wherein any length of cord may be withdrawn and the bob clamped to the cord to restrain the operation of the winding up means until it is desired to release the same.

COMBINATION TOOL.—R. H. DEAN, Leeds, Sioux City, Iowa. Among the objects of this invention is to provide a tool which performs a number of functions in connection with the valves of internal combustion engines, and is particularly adapted for use in connection with the removal of the valve on the engine cylinder, to raise the rocker arm and also to compress the valve spring to permit a release of the pin in the valve stem holding the spring assembled thereon.

DRILL TIGHTENING AND LOOSENING JACK.—S. LA POINT, 1618 E. Jefferson St., Tulsa, Okla. The invention relates generally to jacks, and particularly to power jacks, the primary object being the provision of a quick adjusting double acting arrangement, more especially an arrangement of this kind which is simple in construction and positive and efficient in its action. The invention is particularly adapted to the tightening and loosening of drilling tools in oil well operations.

Heating and Lighting

STOVE CASING.—J. C. R. ABERNATHY, c/o Manual Training School, Pullman, Ill. The invention has for its object the provision of a casing for covering a cook stove to conceal the mechanical features thereof while not interfering with the passage of heated air and not interfering with the use of the stove in its cooking capacity, the case being formed with holes registering with the holes in the top of the stove and closable by removable lids.

INCENSE BURNER AND LAMP.—LILLIAN M. and W. A. RHODES, address Wm. A. Rhodes, 195 Broadway, New York, N. Y. An object of this invention is to provide an incense burner and lamp with an opening in the top of the lamp for permitting the rays to be projected from the lamp and also for permitting the escape of smoke from the incense burner so that an illumination of the smoke will be provided without affecting the usual illuminating results secured by the lamp.

Machines and Mechanical Devices

GAUZE FOLDING MACHINE.—M. WILLNER, 191 Stanton St., New York, N. Y. The object of the invention is to provide a device wherein gauze or other narrow strips of cloth may have the edges folded and then folded along a central line in a continuous operation. A further object is to provide a folding device for bandage gauze now in common use in hospitals wherein the parts will fold the gauze and then wrap the same into a disk, folding same so that the raw edges will be turned in.

GATE VALVE LOCK.—F. R. MCCARTHY and E. C. COMBS, 418 N. Osage, Ponca City, Okla. This invention has for its object to provide a gate valve lock which will be effective to securely incase and protect the operating stem or similar operating means of the valve and preclude the possibility of unauthorized persons opening, closing or otherwise changing the adjustment of the valve.

FRUIT CLEANING MACHINE.—A. O. MOE, Toppenish, Wash. An object of this invention is to provide a fruit cleaning machine more especially designed for subjecting apples and similar fruit to a repeated wiping and brushing action to insure thorough cleaning and polishing of the fruit without danger of bruising the same. A further object is to provide for the cleaning of a large number of apples in a comparatively short time.

CLOTH HOLDER FOR CUTTING TABLES.—M BRETH and T. R. ATKINSON, 200 5th Ave., New York, N. Y. The invention particularly refers to attachments for holding the ends of layers of cloth on the table during the cutting operations. Among the objects is to provide a device including a weighted arm for direct holding contact with successive layers of the cloth and supporting means adapted to hold the arm in different elevated positions above the pile of cloth, and a counter or tallying device coöperating with the weighted arm for registering the number of plies of cloth.

Musical Devices

AUTOMATIC WINDING DEVICE FOR PHONOGRAPHS.—S. A. and R. I. WOLFRUM, 3825 N. Springfield Ave., Chicago, Ill. The invention relates to electrically operated winding devices for phonographs. An object is to provide a device which may be attached to the ordinary spring driven motor for operating phonographs, by means of which the motor may be wound by an electric motor, or manual means as desired.

CABINET FOR PHONOGRAPHS OR TALKING MACHINES.—R. R. M. HALL, address D. M. Hall, 2412 6th Ave., W., Seattle, Wash. This invention has for an object to secure the most desirable results of sound and tone in the use of talking machines. Another object is to provide a cabinet which can be used with the conventional talking machines that will much improve the functions of the same. The construction is particularly adapted for use in large public places, large rooms, or outdoor work.

Prime Movers and Their Accessories

SPARK PLUG.—L. ENRICHT, Farmingdale, L. I., N. Y. The invention relates to internal combustion engines; its object is to provide a spark plug arranged to securely hold a central electrode insulated in the plug body without danger of producing a short circuit. Another object is to dispense with the usual porcelain insulating tube by providing an insulation which is not liable to break, and which when placed in position in the plug forms a permanent part thereof.

Pertaining to Vehicles

SHOCK ABSORBER.—M. G. REED, Brookville, Pa. This invention has for its object the provision of a construction wherein means are provided which will not prevent a free up or down initial movement of the wheel or axle, but will yieldingly resist a return movement. A still further object is to provide a pair of spring-pressed pivotally mounted members arranged to produce friction when the axle moves up or down independent of the body of the vehicle.

STEERING DEVICE FOR MOTOR VEHICLES.—J. W. PRICE, Genl. Delivery, Tulsa, Okla. The object of the invention is to provide a mounting for the front wheels, wherein the spindles are rigid with the wheel hubs and are journaled in bearings in forks on the ends of the front axle to swing on vertical axes, to permit the steering of the vehicle; the device is dust proof, having a minimum of friction, and is capable of being quickly assembled.

RADIATOR FOR WATER-COOLED MOTORS.—R. F. ERKENS, 596 4th Ave., Astoria, L. I., N. Y. This invention has particular reference to means for causing the rapid cooling of a relatively large volume of water by a forced circulation of air drawn from outside of the front part of the machine, the air being caused to circulate upward through the water and serving thereby to extract the heat. The water chamber is so designed that water is maintained in a large volume without subdivisions, thus reducing the danger of freezing.

STEERING KNUCKLE.—J. S. BAIRD, 2525 W. 36th Ave., Denver, Colo. The invention relates to steering means for the front wheels of automobiles; its general object is to provide a knuckle which is stronger than the steering knuckles generally employed, as well as insuring the element of safety, such as will resist side stresses as well as jars and jolts, and desined to better distribute the burden of the load weight imposed thereon. The device may be easily assembled or disassembled and conveniently installed.

STEERING GEAR.—O. S. PULLIAM, 208 W. 56th St., New York, N. Y. This invention has as its primary object to provide a steering gear in which the shocks to which wheel steering wheels are subjected are prevented from being transmitted to the steering gear and hand wheel. The device comprises a disk member having a spiral slot or groove and a rocking lever, one end of which projects into the groove in such manner that as the disk is rotated the lever will be rocked with a subsequent movement of the steering wheels.

Every Automobile Its Own Elevator

(*Continued from page 75*)

to depend upon elevators to transport a few units at a time—again making up the train when the desired level is reached. The motor ramp is designed so as to avoid this interruption to speedy transfer and lends itself to the inter-floor travel of these trailer trains in their entirety.

Without further elaboration, it should be self-evident that the d'Humy system is susceptible of meeting a very wide range of service demands, and may be the means of doing away with operations that now occasion much loss of time and the imposition of heavy charges. Finally, let it be said that the immediate future of the automotive industry is dependent upon the prompt providing of ample garage facilities in our principal cities. Many a prospective car owner is hesitating because he cannot be sure of a convenient place in which to house such a vehicle; and it is likewise vital that these accommodations be offered at prices that will be in keeping with the average purse. The motor ramp, as Mr. d'Humy has conceived it, seems to offer the relief so much desired. His solution of a vexed problem is so simple that one wonders why it has not been developed before.

A Near-Diesel Engine for the Airplane

(*Continued from page 65*)

two pistons per cylinder; it possesses no valves.

As shown by the illustration the pistons are opposed *head on*, there being two separate crankshafts, one for each six pistons. The two crankshafts are connected by gearing at one end of the crankcase. One piston uncovers the intake ports when it nears the bottom of its stroke and the other piston uncovers the exhaust ports. The exhaust ports are larger and are uncovered first. The cycle of events during one complete revolution is as follows, beginning with the piston at top dead center on the compression stroke. A measured quantity of fuel has just been sprayed into the chamber through the nozzle seen in the bottom of the sectional drawing. This spreads through the highly compressed pure air in the combustion chamber. Just then a spark occurs and ignites the mixture. The pistons move out simultaneously until the exhaust ports are uncovered by the left piston. A large part of the burned gases escapes at once to the big, annular chamber surrounding these ports. Then as the pistons move a little farther the intake ports are uncovered by the other piston and a charge of pure air surges in, sweeping before it the burned gases and driving them out of the exhaust ports. By the time that the intake ports are covered by the return stroke of the piston all exhaust gas has been driven from the cylinder and nothing but pure air remains. Air is delivered to the intake ports under slight pressure imposed by a blower built into one end of the engine. Continued inward movement of the two pistons compresses the air and when the pistons are close to upper dead center a new charge of fuel is injected, a spark occurs and the cycle is repeated.

The weight per horsepower is low (1.5 pounds) because there are twice as many power strokes as in the ordinary engine. The reliability of the engine is increased because the engine is very much simpler than the usual four-cycle type in that it has no valves, although the fuel injection apparatus and the double crankshaft nullify this advantage to some extent. The engine is in perfect balance since the in and out movements of the reciprocating parts in each cylinder absolutely cancel each other. Better fuel economy is obtained because higher pressure is used, exhaust back pressure is eliminated (referring to the pressure on the exhaust stroke in a four-cycle) and because the Diesel cycle is inherently more efficient. It is safer against fire since the air and gasoline are not mixed except within the cylinder walls.

Developing One Million Horsepower from Tidal Energy

(*Continued from page 67*)

industrial area of South Wales; thirdly, to the English Midlands, of which Birmingham is the most important center; and fourthly, there will be the supply of the Thames Valley and London, which is 115 miles from the power station.

A lock capable of passing the largest ocean vessels will be built near the center of the dam at the upper end of the channel into which the turbines discharge. Vessels will be towed through this channel by electric towing engines, moving on each wall of the dam, and the lock will be provided at each gate with a bascule bridge for the passage of railway trains and shipping.

The area of the deep-water basin above the dam will be 27 square miles. Along the banks will be built suitable piers, warehouses and storage yards to accommodate the shipping and freight. On the land back of the docks will be erected the various industrial plants, which, as at Niagara, will be drawn to the Severn by the prospects of cheap building sites, abundant electrical power, and good rail and shipping facilities.

A Daring Ship Design

(*Continued from page 68*)

mixture of one part cement to one part of crushed coke, ½ inch and smaller, which gave a weight of 110 pounds per cubic foot exclusive of reinforcing, as compared with 150 pounds for ordinary concrete.

The thickness of shell was greater in these vessels than would ordinarily be used, because of the omission of transverse framing. Thus the concrete of the cylindrical sections is ten inches thick at the bottom and seven inches at the top. The interior surface of all oil compartments was given two coats of spar varnish, and the outer hull surface painted with a bridge cement.

The first tanker was successfully launched sideways July 24th and found to draw almost exactly the calculated amount of water. The second tanker will be ready for launching shortly.

Each vessel is 298 feet long overall, 33 feet 9 inch beam and 21 feet 10 inches deep. The full load draft will be 18 feet.

"Koka Seki" and Its Uses

"KOKA SEKI" is a variety of pumice stone which, as far as now known, reports Vice Consul H. T. Goodier of Yokohama, is only found in the small group of Nijima Islands (New Islands), which lie off the coast of the Idzu Peninsula about 90 miles south of Tokyo. Though used in Nijima from ancient times as a building material, only comparatively recently has "Koka Seki" become known commercially in Japan proper. Because of its durability, high tensile strength, and capability of resisting 1,300°C. of heat, it is suitable for boiler and furnace construction as well as inner linings of safes and the manufacture of ice chests. As it is claimed, it can be easily cut, will take a surface of paint or metal plating, and as nails can be driven in it it is thought that the uses of this material will greatly increase. It is, however, in reinforced concrete barge building in Japan that it is best known. This concrete is stated to be about 60 per cent lighter than the ordinary kind, and is said to be absolutely resistant to seepage, water erosion, or serious breakage by freezing and thawing. An estimate cost of such a reinforced concrete barge with a cargo capacity of 180 tons is given as $6,979, or in orders of five vessels each, as $5,982 apiece. The current prices of "Koka Seki" in Tokyo are about 1 yen ($0.50) per cubic foot for blocks, and 33 sen ($0.17) per cubic foot for flakes and sand.

Annual Subscription Rates
Scientific American Publications

Scientific American (established 1845) one year $6.00
Scientific American Monthly (established 1876) one year $7.00

Postage prepaid in United States and possessions, Mexico, Cuba and Panama.

Foreign Postage
Scientific American $1.50 per year additional.
Scientific American Monthly 72c per year additional.

Canadian Postage
Scientific American 75c per year additional.
Scientific American Monthly 36c per year additional.

The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application.

Remit by postal or express money order, bank draft or check.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to Correspondents are printed from time to time and will be mailed on request. Please write your queries; do not telephone them, please.

(14359) C. E. C. asks: Please tell me through your Questions and Answers Department how to drill holes through glass. A. To drill glass, prepare a solution of camphor in turpentine and add some ether. While proportions are not very important, a good solution is made by taking spirits of turpentine 1½ oz., camphor 1 oz., and ether 3 drams. Break the tip from a 3-cornered file so as to have a sharp and very hard point, dip the tip of the file in the solution and give it a twisting motion on the glass where the hole is to be made. Use sufficient pressure to cut the glass but not to break it. Practice will soon enable you to do the trick. Work on odd pieces of glass till you get experience. Be very careful when the tip of the file is about to come through the glass. After the hole is made it can be enlarged to any size by a round file. Keep the glass constantly wet with the solution.

(14360) F. A. says: Is it a fact that in Norway water power is used to extract nitrogen from the air which is used as a soil fertilizer? If so, how is it done, and in what form is the nitrogen applied to the soil, as a liquid or as a gas, I do not think that it could be successfully mixed with the soil in the form of gas. It has always seemed wonderful to me that plants of the legume family are enabled to withdraw nitrogen from the air and by storing it in their roots enrich the soil for other plants, but it also seems wonderful if this process can be duplicated by mechanical means and if you have ever printed an article on the subpect I would be very glad to forward stamps for it. A. Nitrogen is taken from the air in Norway by water power. The water power drives a very powerful dynamo by which an enormous electric arc and tremendous heat are produced. The air is driven through this arc and the heat forces the nitrogen and the oxygen of the air to combine into an oxide of nitrogen, which passed through water, becomes nitric acid. This in turn acts upon broken limestone and forms calcium nitrate which is a fertilizer. It is by causing the nitrogen to combine with oxygen that the nitrogen which is taken from the air is able to become useful as a fertilizer and also in making explosives such as smokeless powder, nitroglycerine and dynamite. Nitrogen cannot be employed as a gas or as a liquid for any of these purposes. Certain plants of the legume family have small nodules, or bunches, on their roots. In these nodules there are bacteria which are able to cause the combination of nitrogen in the gaseous forms with other gases to form substances which can act as fertilizing agents. Nitrogen uncombined is of no value in manufacturing or in farming. In ammonia or nitrates it is very valuable everywhere, and in many ways. The United States Government is now building large works for making nitrates from the air.

(14361) R. S. S. says: A friend, a citizen of one of our great allies who by his various remarks indicates that he begrudges us much of the well-merited credit for our part in the world war, has made the statement, on the authority of one of our great university presidents (who, however, may have been misquoted), that not a single scientific development, invention or innovation of any sort has been made by an American during the world war which played any part in bringing about its successful conclusion for the Allies. I appreciate that this may readily be true without detracting from the glory gained by our arms, but it occurs to me that this statement may be challenged. I would therefore greatly appreciate information regarding the following questions, which I write down off-hand and also any additional accomplishments to which you can refer me, tending to refute the above statement.

(1) Is Dr. Alexis Carrel an American and did he not discover the "irrigation method" in the treatment of wounds?

(2) Was the "depth bomb," as used in U-boat warfare, an American invention?

(3) Was the "smoke screen" first proposed by an American as a weapon against the U-boat?

(4) Was the submarine detector (acoustic device) developed to a practical point and was it an American development?

(5) Who first proposed "camouflage" for ships as a defensive measure against the U-boat?

(6) Was a practical "static neutralizer" for wireless developed and was an American its inventor?

(7) Was wireless telephony used practically in the war, by whom, and who perfected it?

(8) Was field artillery with so-called split tail-pieces used exclusively in the American army and was it an American development?

(9) Did we develop new poison gases and did they come into use?

(10) Was the Browning gun used to an appreciable extent by our troops?

(11) Assuming the "Liberty motor" possessed many points of merit over other aircraft engines, was its design solely American and were they used in appreciable quantities by our fliers?

A.—(1) If we are not misinformed, Dr. Carrel is an American citizen of French birth. We understand that he developed the treatment mentioned.

(2) The "depth bomb" was developed in the destroyer service and, we believe, was perfected by the American force abroad.

(3) The "smoke screen" was first used by our destroyer fleet in naval maneuvers against the battleship fleet prior to the recent war.

(4) There are now several excellent "listening devices" in use, some French, some English and others American. We believe that the American device was first used successfully.

(5) The English used camouflage prior to our entry into the war.

(6) We know of no "static neutralizer" for use with wireless that is as satisfactory as a good operator. There is a current saying that "static" varies inversely with the proficiency of the operator.

(7) The most satisfactory use for wireless telephony with which we are acquainted was in the "submarine chaser" flotilla. It was an American development.

(8) We regret that we are unable to answer this inquiry.

(9) Several types of gas were developed in this country and used abroad, more especially along the lines of "mustard gas," "lachrymal gas," etc., which were temporarily incapacitating.

(10) The Browning gun was not manufactured in large quantities in time to be much of a factor.

(11) The "Liberty motor" is supposed to combine the good points in practically all automobile and aeronautic motors. It was entirely an American development. The actual delivery of motors in quantity did not start in time to allow extensive competition with foreign makes.

In speaking of developments aiding in winning the war, probably the greatest of all were the developments in repair methods which permitted the use of the damaged German shipping when they were most needed. The one development most in evidence was electric welding of cast iron, etc. To this alone is due the transportation of a surprising percentage of our troops to the front. This was distinctly American.

(14362) M. A. D. asks: 1. What causes the explosive report occurring almost simultaneously with a heavy discharge of lightning? 2. Is a ball of lightning, as often termed, a high positive charge electric spark? 3. Has the voltage of lightning ever been recorded or estimated? A.—1. When the thunder comes almost simultaneously with the flash of lightning the flash is very near you. The sound of thunder travels in the same manner as all other sounds, with a velocity of not far from 1,120 feet per second, or about 5 seconds per mile. The usual way to estimate the distance to a flash of lightning is to take the time between the flash and the report, and allow 5 seconds to a mile. The rumbling of thunder is due to reflections from different parts of the cloud. 2. We do not know what ball lightning is. 3. The voltage of a flash of lightning depends upon its length, or the distance of the cloud above the earth. This varies very greatly, from a few feet up to perhaps a half mile.

NEW BOOKS, ETC.

A TEXT-BOOK ON MACHINE DRAWING FOR ELECTRICAL ENGINEERS. By Edward Blythe, A.M.I.Mech.E. London: Cambridge University Press, 1920. 4to.; 81 pp.; 48 plates.

The author would extend the same aid to the electrical engineer as many existing texts offer the mechanical engineer. He presents a course in drawing that deals with the constructive details of electrical machinery and apparatus, so that lecture room theory may be reinforced by more practical knowledge. His examples are systematically progressive, through elementary projection to the making and reading of working drawings. The most modern types of apparatus are portrayed, and the whole forms a good introductory treatise on construction.

NOTES ON CHEMICAL RESEARCH. By W. P. Dreaper, O.B.E. Philadelphia: P. Blakiston's Son and Company, 1920. 8vo.; 195 pp.; portrait.

A second edition of this work has provided opportunity for enlargement. Graduate students will find it a succinct account of the conditions which apply to original investigation, the first part of the book dealing with scientific fact and method, the second with aims and methods, embracing industrial practice and organization. The discussion confers a greater ability to "see into things," a realization of the relative importance of observations, and a better judgment of the correctness and value of deductions.

BURGESS BLUE BOOK. Compiled by Yorke Burgess. Chicago: The Burgess Company. 16mo.; 108 pp.; illustrated.

Students and practical men will appreciate the electrical formulas, drawings, problems and calculations contained in this pocket-size instructor. Understandable drawings of shunt, series and compound motors, controllers, autostarters, etc., are interspersed and succeeded by rules, suggestions and information of great value; the properties and capacities of various wires are given, with practical calculations; and dynamos and motors are described and their troubles elucidated.

CATALYSIS AND ITS INDUSTRIAL APPLICATIONS. By E. Jobling, M.C. Philadelphia: P. Blakiston's Son and Company, 1920. 8vo.; 144 pp.; illustrated.

The second edition of this valuable treatise is almost a new work. The acceleration of chemical action by foreign bodies is a fact of which industry is widely availing itself, and the more recent extensions of its use are detained by the author. Sulfuric acid manufacture and the fixation of atmospheric nitrogen are but two of many applications treated of in this book, which, by its scope and its inclusion of the latest knowledge, commends itself to all students of industrial chemistry.

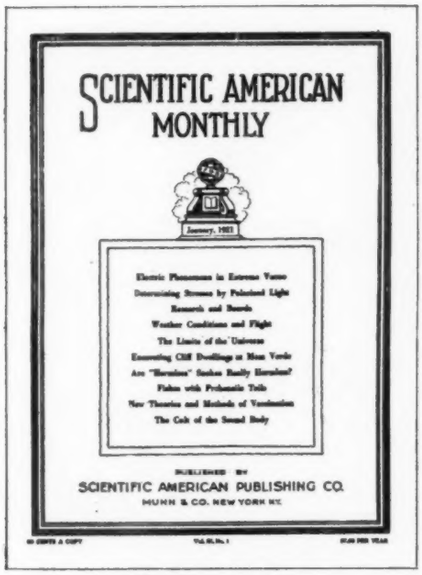
TERTIUM ORGANUM. (The Third Organ of Thought.) By P. D. Ouspensky. Translated from the Russian by Nicholas Bessaraboff and Claude Bragdon. Rochester, N. Y.: Manas Press, 1920. 8vo.; 344 pp.; illustrated.

Is Russian thought to be the connecting link between the mysticism of the East and the realism of the West? Ouspensky's fourth-dimensional philosophy as set forth in "Tertium Organum" inclines us to this belief. It is perhaps the heaviest gun Idealism has yet fired; but its genius lies, not in the infallibility of its conclusions, but in the projective power of its concepts coupled with an amazing simplicity of expresson. It is a search for the means of that "expansion of consciousness" at which all religions aim. It errs, as they err, in insisting upon repudiation of the physical environment as the path to higher development. Safe advance comes by a superposition of concepts analogous to the stereoscopic vision, not by immediate supersedure of the old by the new.

SPOT AND ARC WELDING. By H. A. Horner, B.A. Philadelphia and London: J. B. Lippincott Company, 1920. 8vo.; 296 pp.; illustrated.

Electric welding has long been successfully used in repair work, but there is a disinclination to trust to this method in new construction. "Spot and Arc Welding" seeks to overcome this disinclination. The writer believes that the weld may beneficially supersede the rivet. The data of the Emergency Fleet Corporation are given in full, and builders and manufacturers will find here much that may readily be adapted to their particular ends. Machines, operations and results are displayed in numerous clear illustrations, theory receives its full quota of space, and a series of appendices handle material of great interest in plate and pressure work.

TO THOSE WHO FOLLOW THE SCIENTIFIC AMERICAN



(Actual size, 9 x 12 inches)

Progress in Mechanical Engineering
Technical Research in Industries
Survey of Mining and Metallurgy
Science and National Progress
Pure and Applied Science
Transmissions of Power
Field of Electricity
Multiple Telephony
and Telegraphy
Bacteriology
Aeronautics
Agriculture

FOR the man whose business or profession demands contemporary news of the daily discoveries and happenings in the sphere of science and industry the SCIENTIFIC AMERICAN has long been an indispensable source of accurate information of the hour.

In the SCIENTIFIC AMERICAN you have the one great scientific newspaper which takes you behind factory doors and into the large laboratories, explaining in language easily understood the workings of scientist, engineer and manufacturer. And today—when the nation's stability awaits early solution of the many problems of economic adjustment, the scientist and his helpmates are bound to play an all-important role.

In recognition of this need, and side by side with the weekly periodical, the SCIENTIFIC AMERICAN MONTHLY is published; a 94-page journal which gives in full detail many important topics which, owing to limitation of space, can be referred to only briefly in the weekly; with hundreds of original contributions, the monthly journal also contains translations of significant articles appearing in the European journals. For the special branches there are separate departments prepared each month by the American Society of Mechanical Engineers, the United States Bureau of Standards, the National Research Council, the United States Bureau of Forestry, and similar sources of authority.

The news of current technical topics is the strict province of the weekly SCIENTIFIC AMERICAN. On the other hand, the MONTHLY presents exhaustive treatment of the thousand and one events in pure and applied science—scientific research in the factories—production aids — applied chemistry — mechanical engineering — mining and metallurgy—agriculture—animal life—aeronautics—etc.

Subscribing to the SCIENTIFIC AMERICAN MONTHLY is insurance in keeping yourself well informed to the most minute detail in the combined achievements of engineer and producer, scientist and inventor. In view of the fact that the one periodical supplements the work of the other, the opportunity is offered below to subscribe to both periodicals at a special combination price—with two dollars saved.

SCIENTIFIC AMERICAN MONTHLY, per copy price, 60c; yearly subscription, $7. SCIENTIFIC AMERICAN (weekly), per copy price, 15c; yearly subscription, $6. Combination subscription price for SCIENTIFIC AMERICAN MONTHLY and the SCIENTIFIC AMERICAN (weekly), sent to one address, per year, $11. To those who follow the SCIENTIFIC AMERICAN we shall be glad to enter your combination subscription immediately upon receipt of your name and address, and bill for same will be mailed to you.

Women Drivers

Do they realize the relation of Engine Lubrication to both Petty and Serious Driving Problems?

MORE AND MORE men drivers are realizing the importance of using the correct oil in their cars. To their wives who drive the cars during the week, the importance of scientific lubrication is even greater.

Driving problems, bothersome enough for men drivers, become more serious when a woman is at the wheel.

Among the driving problems which bother women, perhaps the most important are these: 1—Engine is difficult to start. 2—Gears have to be shifted on hills and in traffic. 3—Engine missing because of fouled spark plugs.

Engine difficult to start

Women drivers use cars largely for short trips. Often the car stands idle outside for several hours. While standing it cools off. Starting a cold engine is always more difficult than starting a warm one. But this difficulty of starting is increased by a low quality of wrong-bodied oil which throws an additional strain on the batteries.

The correct grade of Gargoyle Mobiloils often surprises motorists by the easier starting which results. This is because the oil is both of the highest quality and of a scientifically correct body. If the Chart specifies a different grade of oil for your car in winter, be sure to use this grade.

Frequent gear shifting

With incorrect lubrication the engine overheats. The valves become sticky. The spark plugs foul. This results in irregular action of the engine, lessening its power. As a result the engine loses its flexibility to a marked degree. Hills formerly taken on high gear must now be traveled in lower gear. Lower gear has to be used too much in traffic. Trouble of this kind is directly traceable to incorrect lubrication, and can be avoided when the motorist follows the Chart on the right.

Spark plugs foul

Engine missing is quite often caused by a fouled spark plug. Removing and cleaning a spark plug is simple enough to a man, but it is a nasty, troublesome job for a woman. Frequent fouling of spark plugs is usually due to incorrect lubrication. With the correct grade of Gargoyle Mobiloils women drivers will experience a freedom from this kind of trouble.

Other operating troubles frequently encountered are — water boiling in the radiator, due to overheating of the engine; excessive smoking at the exhaust; and other annoyances, all of which are usually traceable to faulty lubrication.

* * * * *

OF ONE THING you may be sure. If you use the grade of Gargoyle Mobiloils specified in the Chart, you are getting maximum freedom from the troubles discussed here. This is a recognized fact in scientific circles and among the more experienced automobile manufacturers, dealers and motorists the world over.

If your car is not listed on the partial Chart to the right send for our booklet "Correct Automobile Lubrication," which contains the complete Chart. Or consult the complete Chart at your dealer's. Be careful to notice what grade of Gargoyle Mobiloils is specified for winter use in your car. In writing, please address our nearest branch.

GARGOYLE

Mobiloils

A grade for each type of motor

Domestic Branches: New York, Boston, Philadelphia, Pittsburgh, Detroit, Chicago, Minneapolis, Indianapolis, Kansas City, Kan., Des Moines

Chart of Recommendations *for* AUTOMOBILES

(Abbreviated Edition)

GARGOYLE

Mobiloils

A grade for each type of motor

How to Read the Chart

THE Correct Grades of Gargoyle Mobiloils for engine lubrication are specified in the Chart below.

A means Gargoyle Mobiloil "A"
B means Gargoyle Mobiloil "B"
E means Gargoyle Mobiloil "E"
Arc means Gargoyle Mobiloil Arctic

These recommendations cover all models of both passenger and commercial vehicles unless otherwise specified.

Where different grades of Gargoyle Mobiloils are recommended for summer and winter use, the winter recommendation should be followed during the entire period when freezing temperatures may be experienced.

This Chart is compiled by the Vacuum Oil Company's Board of Automotive Engineers, and constitutes a scientific guide to Correct Automobile Lubrication.

If your car is not listed in this partial chart, consult the Chart of Recommendations at your dealer's, or send for booklet, "Correct Lubrication," which lists the Correct Grades for *all* cars.

NAMES OF AUTOMOBILES AND MOTOR TRUCKS	1920		1919		1918		1917		1916	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
Acason (2 ton)			A	A	A	Arc	A	Arc	A	Arc
" All Other Models	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Allen	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Apperson (8 cylinder)	A	A	A	A	A	A	A	A	A	A
" All Other Models					A	A	Arc	Arc	Arc	Arc
Atterbury (Model 6-8)	A	A	A	A						
" All Other Models	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Autocar (2 cylinder)	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Buck	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Briscoe (4 cylinder)	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (8 cylinder)									A	A
Buick	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Cadillac	A	A	A	A	A	A	A	A	A	A
Chalmers (6-48)									Arc	Arc
" (6-60)									A	Arc
" All Other Models	A	A	A	A	A	A	A	A	A	A
Chandler Six	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Chevrolet (8 cylinder)			A	A	A	A				
" 4 P. A.			A	Arc	A	Arc				
" (T. B. and 1 ton)	A	Arc								
" All Other Models	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Cleveland	A	Arc								
Columbia (Detroit)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc		
Cunningham	A	A	A	A	A	A	A	A	A	A
D-E (3/4 and 2½ ton)	A	Arc	A	Arc	A	Arc	A	Arc		
" (1 ton)	A	A	A	A	A	A				
" All Other Models	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc*		
Dodge Brothers	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Essex	A	Arc	A	Arc						
Federal (Model S-X)					A	A	A	A		
" (Special)					Arc	Arc				
" All Other Models	Arc	Arc	Arc	Arc						
Ford	E	E	E	E	E	E	E	E	E	E
Franklin	A	A	A	A	A	A	A	A	A	A
Grasm-Bernstein (3 ton)	A	A	A	A	Arc	A	Arc			
" All Other Models	Arc	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Grant (6 cylinder)	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (Com'l) (Model 12)			A	Arc						
" (") All Other Models	Arc	Arc	Arc	Arc						
Haynes (6 cylinder)	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (12 cylinder)	A	A	A	A	A	A	A	A	A	A
Holmes	B	A								
Hudson Super Six	A	Arc	A	Arc	A	Arc	A	Arc	A	A
" All Other Models									Arc	Arc
Hupmobile	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Jordan	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc		
Kelly Springfield	A	A	A	A	A	A	A	A	A	A
King (8 cylinder)	A	A	A	A	A	A	A	A	A	A
Knox Kar (Model 46)									A	A
" (12 cylinder)					A	A	A	A		
" All Other Models	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Koehler (Model M)	A	A	A	A						
" All Other Models	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Liberty	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc		
Locomobile	A	E	A	E	A	E	E	E	E	E
Madison (6 cylinder)			A	Arc	A	Arc	A	Arc	A	Arc
" (8 cylinder)							A	A	A	A
Marmon	A	A	A	A	A	A	A	A	A	A
Maxwell	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Mercer	A	A	A	A	A	A	A	A	A	A
M. H. M.	A	Arc	A	Arc	A	Arc	A	Arc	A	A
Mitchell (6 cylinder)	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (8 cylinder)									A	A
Moline-Knight			B	A	B	A	A	A	A	A
Nash (Quad)	A	A	A	A	A	A				
" (Model 671)					A	A				
" All Other Models	A	Arc	A	Arc	A	Arc				
National (6 cylinder)	A	A	Arc	Arc	Arc	Arc	Arc	Arc	A	Arc
" (12 cylinder)			A	A	A	A	A	A	A	A
Nelson	A	A	A	A	A	A	A	A	A	A
Oakland (8 cylinder)					A	Arc	A	Arc	A	A
" All Other Models	A	A	A	A	A	Arc	Arc	Arc	Arc	Arc
Oldsmobile (4 cylinder)	A	Arc	A	Arc					Arc	Arc
" (6 cylinder)	A	A	A	A	A	A	Arc	Arc		
" (8 cylinder)	A	A	A	A	A	A	A	A	A	A
Overland	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Packard	A	A	A	A	A	A	A	A	A	A
Paige (6 cylinder)	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (Cont. Eng.)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" All Other Models	A	A								
Paterson	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Peerless (8 cylinder)	A	A	A	A	A	A	A	A	A	A
" All Other Models					A	Arc	A	Arc	Arc	Arc
Pierce Arrow	A	A	A	A	A	A	A	A	A	A
" (Com'l) (1 ton)	A	A	A	A	Arc	Arc	Arc	Arc	Arc	Arc
" (") All Other Models	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Premier	A	A	A	A	A	A	A	A	Arc	
R. & V. Knight	B	A								
Reo	A	A	A	A	A	Arc	A	Arc	A	Arc
ReVere	A	A	A	A	A	Arc				
Riker	A	A	E	A	E	E	E			
Rock Falls	A	Arc	A	Arc						
Saxon			E	E	E	E	E	E	E	E
Sayers 3/4	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc		
Sayers & Scoville (6 & 8)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Scripps-Booth (4 cylinder)					Arc	Arc	A	Arc	A	Arc
" (6 & 8 cylinder)	A	A	A	A	A	A	A	A	A	A
Selden (½ ton)							A	Arc		
" (1 ton)	A	A	Arc	Arc	Arc	Arc				
" All Other Models	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Service (120-130-140-170-220)	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" All Other Models	A	A	A	A	A	A	A	A	A	A
Stearns-Knight	A	A	B	A	B	A	B	A	B	A
Studebaker	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Stutz	A	A	A	A	A	A	A	A	A	A
Templar	A	A	A	A	A	A				
Velie (Model 34)	A	Arc								
" (6 cylinder)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (Com'l) (¾ ton)			A	Arc						
" (") All Other Models	Arc	Arc	Arc	Arc	Arc	Arc				
Westcott	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
White (16 valve)			A	A	A	A	A	A		
" (3 ton)			A	A	Arc	Arc				
" All Other Models			Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Willys-Knight	B	A	B	A	B	A	B	A	B	A
Willys Six	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc		
Winton	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc